THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVI. No. 1939.] LONDON, JULY 10, 1900. 52ND YEAR. PRICE 6d.

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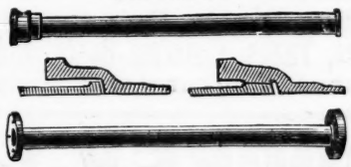

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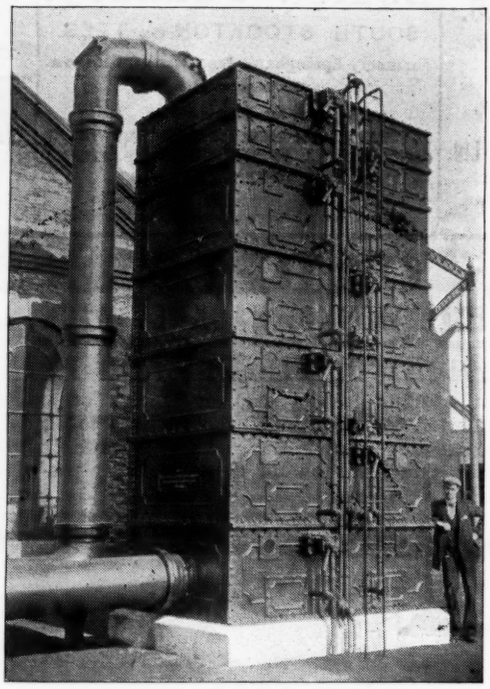

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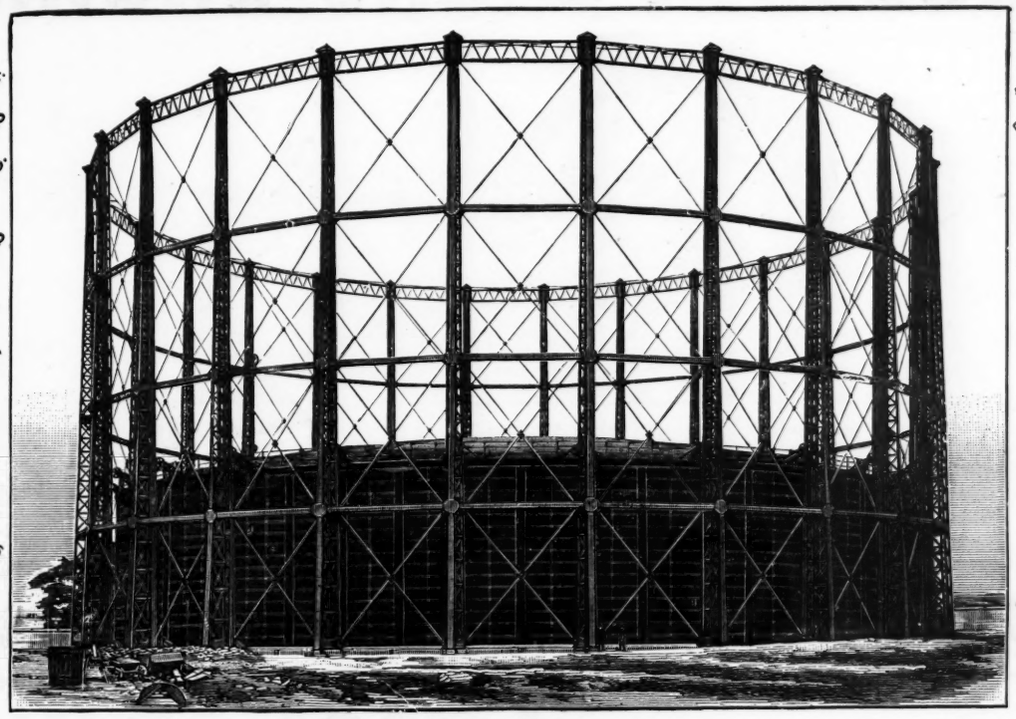

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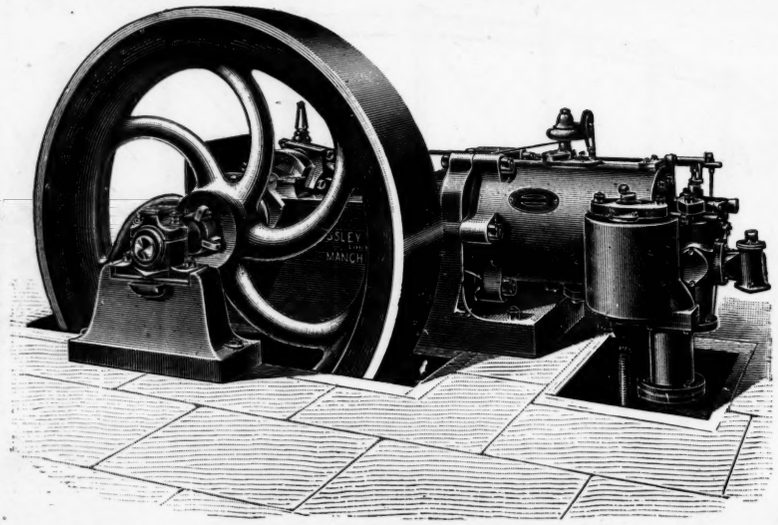

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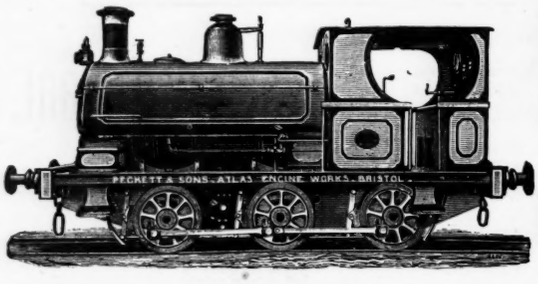

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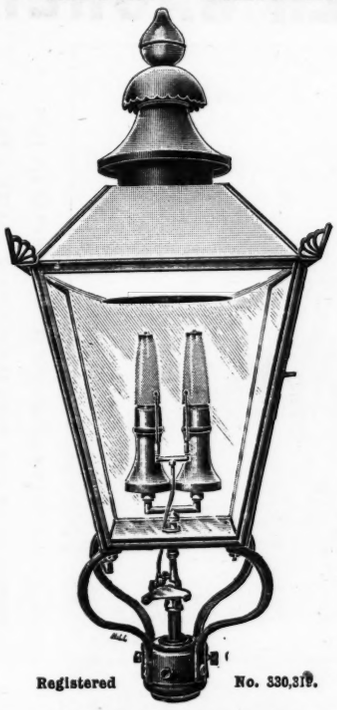

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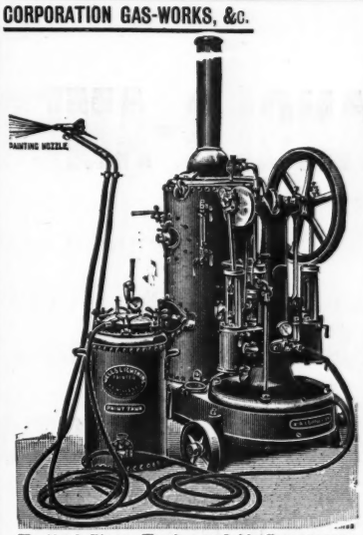

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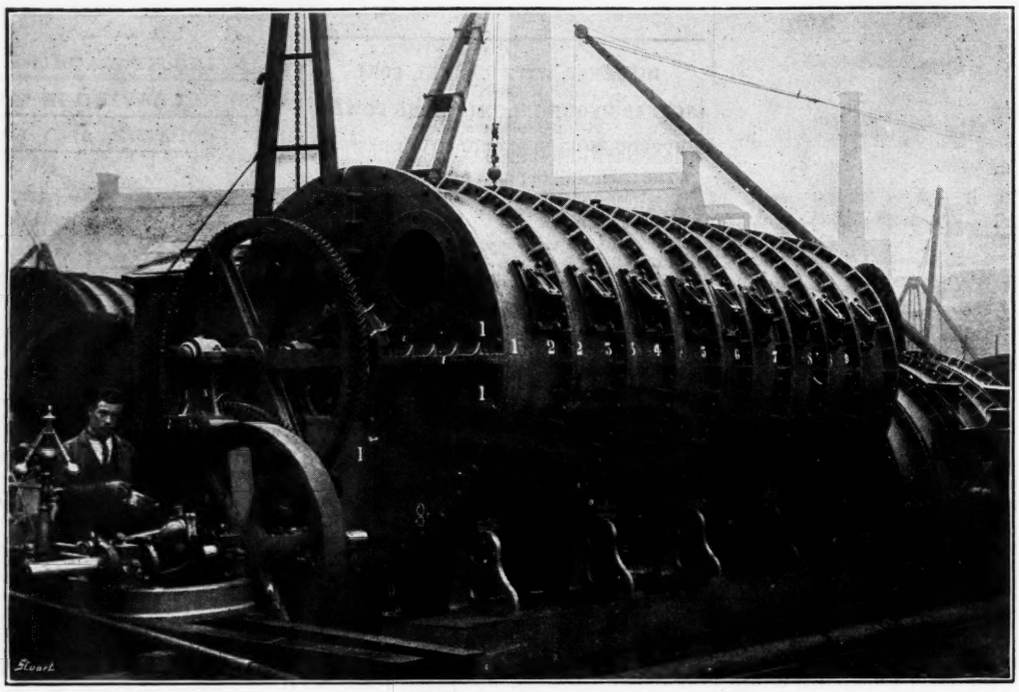

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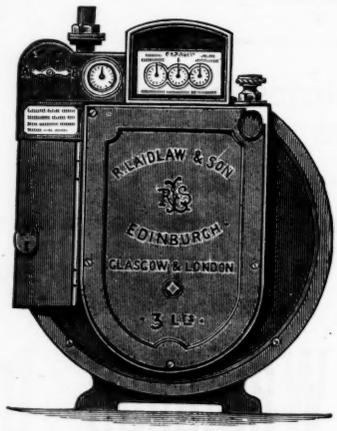

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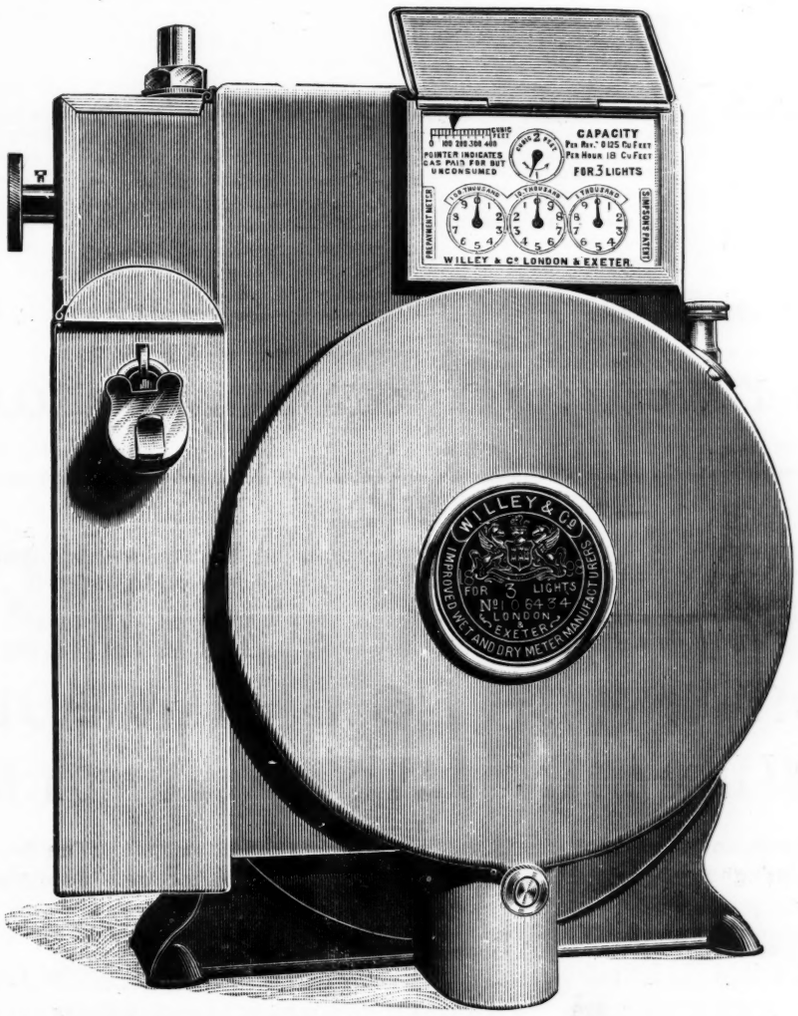

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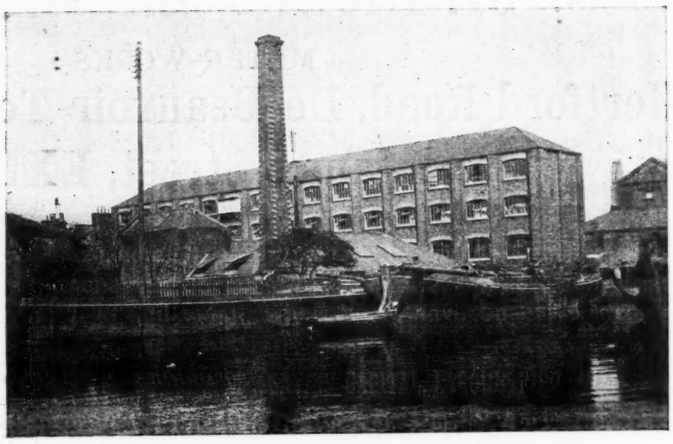

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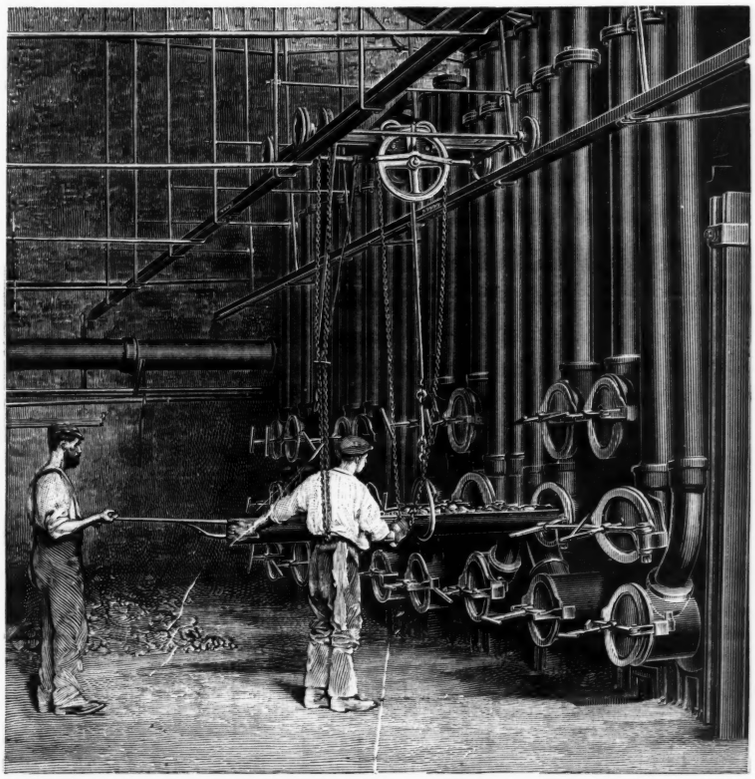

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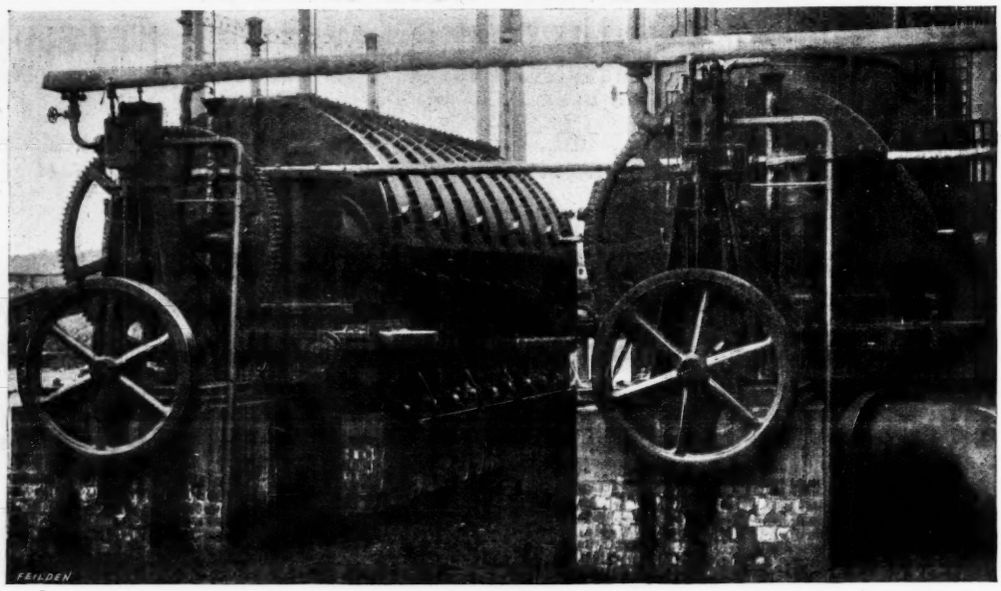

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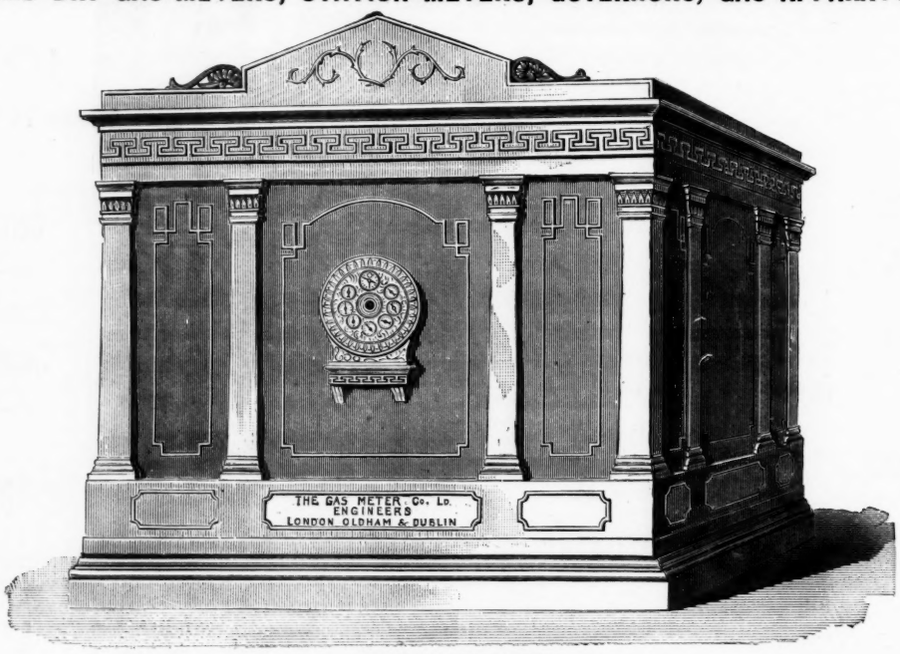

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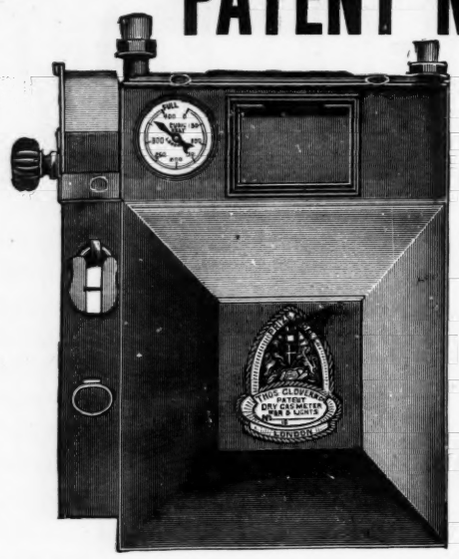

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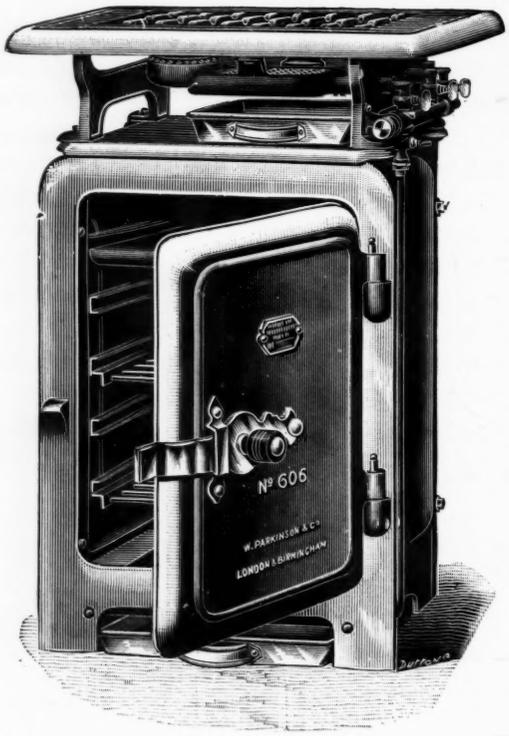

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EDITORIAL NOTES.

Action on the Kern Burner Patent.

WHAT will probably prove to be the last but one of the big patent actions over the incandescent gas-light system was heard last week by Mr. Justice Buckley in Queen's Bench Court No. 1, which was converted for the time being into a hall for the demonstration, *sub judice*, of the characteristics of various and sundry patented forms of incandescent burners. The action was, in form, a petition on behalf of the New Sunlight Company for the revocation of the Kern patent for an improved bunsen burner, on the grounds of an alleged anticipation by De Mare, and also of a lack of proper subject-matter for a patent, misleading directions in the specification, and bad claims. It thus appears that, from the point of view of the petitioners, this celebrated patent, which has cost the Welsbach Company £80,000 in cash, and has been reputed to do wonders in respect of raising the lighting efficiency of the incandescent mantle, had almost all the defects that a patent can possibly exhibit to the discerning eye. It is a peculiarity of actions for revocation of patent that they require the respondent's case to be heard first. He therefore has the considerable advantage of being able to tell the presiding Judge what his invention is, and of showing just how his patent covers it. First impressions are regarded as valuable in these patent cases, because the Judge, who begins with a mind perfectly blank, naturally looks at the matter for the first time in the light in which it is presented to him. Still, of course, a Judge would not be worthy of his office if he had not the power of resisting the temptation to form an opinion before hearing both sides of the story.

This Kern burner case will be memorable in the annals of the Chancery Division for one strange circumstance attending the hearing. Early in the proceedings, Mr. Bousfield, Q.C., for the petitioners, informed the Judge that it was the desire of his clients to fight the case out strictly upon the merits; and that, in accordance with this wish, they proposed to do all the necessary elucidatory experiments under the eye of the Court. There was to be as little relying as possible upon the mere word of expert witnesses; everything being done that could be done to base the arguments upon indisputable facts. The immediate result of this way of stating the respective cases was to nearly kill the Counsel and the experts engaged; because, as fast as any important point arose in Court, an engagement was given that the question should be tried experimentally. The consequence was that, after the day's talking, the night had to be dedicated to experimental observations, open to both parties. It was hard upon the professional men engaged, who all looked sadly "stale" by the end of the week; but the parties reaped the benefit of having the issues very clearly brought out and placed before the Court. We shall not attempt here to summarize the evidence. The Kern burner and the De Mare burner both utilized the principle of the Venturi tube; and the contention of the petitioners was that there is no such substantial difference between the two applications of this well-known principle as to form fit subject-matter for a patent. If anything, Kern's forms and dimensions were slightly better than De Mare's; but mere differences of form, order, or dimensions, even of considerable range, are legally debarred from being patentable. Counsel for the petitioners declared that this objection of anticipation was so well founded as regards Kern's patent, that they might have claimed its revocation on this ground alone.

In addition, however—and this contention gave rise to most interesting experiments—it was urged that Kern had committed himself to a mistaken theory of the cause of the efficiency of his burner. He pinned himself to an ideal which was demonstrably mistaken; and accordingly in his directions he misled those who might trust him as the guide to the manufacture of the best burner for use with an incandescent mantle. Kern imagined that what was required of a burner was the production, at normal pressures of gas and air, of a mixture of the two in the equivalent ratios for complete combustion of 1 to 6. Against this, it was asserted that the idea is erroneous, and that in any case the Kern burner does not, in fact, produce such a mixture. Positive evidence was offered to show that the best mixture for the purpose is 1 of gas to about 4 of air, when the combustion is completed by access of the air surrounding the mantle, which is then subjected to the most intense heat that can possibly be spread over so large a surface as that of a mantle. It was contended that this is, in fact, the very mixture with

which the Kern burner does its work. The contention shows the danger of putting theory into a patent specification. It is useless to do so, in any case, because one cannot patent a theory. The chances are that, while the practical result may be all right, the theory is wrong. This will not necessarily invalidate a patent, if the hypothesis is indulged in as a mere "aside," so to speak, and is not allowed to govern the patentee's prescription, or to appear in any of his claims. If it does, the patent is lost.

Such, recounted as briefly as possible, were the issues upon which this most interesting technical case was tried by Mr. Justice Buckley for more than a week. Mr. Moulton began his reply on the whole case, for the respondents, late on Friday afternoon. He spoke all Saturday, and for the greater part of yesterday; this fine forensic effort being one of the most brilliant pieces of advocacy ever employed in a gas patent case. But, unfortunately, the extremely elusive nature of much of the evidence—consisting as it did of references to the dimensions and performances of "exhibits" put in on both sides—renders reporting extremely difficult. Everyone who followed the hearing agreed that it was one of the hardest-fought cases on record, and also that the points at issue were extremely perplexing. Even as late as yesterday, Mr. Moulton invited the Court to order further experiments; but the Judge declined, on the ground that he already had ample material upon which to base his judgment. At the conclusion of Mr. Moulton's reply, there was a small final dispute between Counsel as to the points of certain cited cases; and the Judge then announced that he would give judgment in a few days.

It is expected that the last, and even more important, action—that on the Welsbach Company's 1893 mantle patent—will be tried before the Long Vacation, so as to save the winner the trade for the ensuing lighting season.

Coal Miners' Wages and their Policy.

The resolutions upon the questions of old-age pensions, the nationalization of coal mines, and other small matters of a similarly general and practicable nature, passed by the Miners' International Congress recently assembled in Paris, are of no importance to practical work-a-day men. But a pronouncement made in the course of the debates by one of the English delegates—a Mr. Haslem—is sufficiently significant, and, if it is to be taken as reflecting the general attitude of the Miners' Federation of Great Britain, sufficiently important, to be noted. Mr. Haslem, referring to the rates of wages now ruling in this country, said: "The "agreement was that in England the increase should not be "more than 60 per cent., and not less than 30 per cent., "above the wages paid in 1888. Yet, to judge from the "price the public were now paying for coal, the miners "should get 100 per cent. more than in 1888. As they "were not sharing proportionately with the present inflation "of prices, they must not be expected to participate in any "future depression of trade." This, if it be the feeling current among the miners, spells mischief in the near future. We have before now, when discussing the troubles in the South Wales coalfields last autumn, which were patched up rather than settled—the old sores still lying below the surface—expressed the opinion that (much as we should like to believe that the tendency which was to be observed last year for disputes between masters and men to be settled without recourse to strikes or lock-outs really evidenced the existence of a more reasonable spirit on the part of the men) the absence of any serious labour troubles in recent times has been mainly due to the upward movement of wages generally. We said then that the real test of the spirit existing among the men would be when wages had to come down with the inevitable reaction in trade, and that when this reaction came we should not be surprised—much as we should regret—to see a recrudescence of labour troubles. It is not, perhaps, a graceful thing to recall one's own words and prophecies; but the ominous remark we have quoted from the debates at the Miners' Congress strikes the very note that nine months ago we heard in anticipation. "It is the "absence of any sufficient guarantee that men will be con- "tent to give as well as take that largely accounts for the "unwillingness of employers to grant an advance of wages "in times of prosperity. The tendency to regard such "enhanced rates of pay as an irreducible minimum, not "unreasonably makes employers chary of granting a tempo- "rarily, but possibly not permanently, justified increase." If the Miners' Federation seriously think of making 45 per cent. above the 1886 standard as the "irreducible minimum," the gas industry will not find the heavy fall in coal prices which is certain to come before a great while an altogether unmixed blessing; for it is certain that the owners would strenuously contest any such proposed minimum, and when masters and men fall out coal is to seek. We do not wish to croak unduly; but it is as well to remember that the industrial millennium has not yet arrived, and that the Miners' Federation are steadily accumulating considerable funds.

Dearer Gas Everywhere.

From reports that have poured in upon us of late, we find that, roughly speaking, fully 250 gas undertakings in the United Kingdom have begun the current quarter with increased prices to private consumers, ranging mostly from 6d. to 9d. per 1000 feet. This is an unprecedented state of things. Perhaps some clever Professors and heaven-sent Town Councillors can tell how it might have been avoided, with coal at ruling rates; but the difficulty of continuing to supply gas at old prices has evidently been too great for the majority of gas companies and municipal gas departments to overcome. It appears that in many places it is not proposed to increase the rates for public lighting; and generally there is great reluctance to alter the cost of slot-meter supplies. Where the advance is made general, it is chiefly by municipal undertakings, which have no reserve funds to help them to tide over the hard times. Nobody can blame them for acting in this way. On the contrary, we have consistently maintained that gas companies ought not to draw upon their regular reserves in the vain endeavour to sell gas for less than it costs to make, when the adverse conditions are otherwise than obviously temporary. The point of the present difficulty is that nobody can yet see the end of it. House and all sorts of industrial coals are dear, and likely to remain so for an indefinite period. Any relief that might naturally have been expected from the expiration of the troubles in South Africa is more than set off by the outbreak of worse mischief in China. The long-dreaded "Yellow Terror" is upon the whole civilized world at last; and it is impossible to forecast the immediate or the distant consequences of the outbreak. Still, gas companies are more amenable than municipalities to the argument for making the best of the situation. Where the companies have contracts with local authorities for public lighting, the latter are, of course, on the right side. As regards the prepayment consumers, present circumstances prove the wisdom of those gas-works administrators who set the price well above the minimum, and preferred returning a trifle from the box to anything like a precise adjustment. It is easy to understand that nothing tended more to give the small consumer a good opinion of the slot-meter arrangement than the habitual receipt of a few coppers as "overs" from the collector. It was a complete guarantee of good faith on the part of the gas authorities. Now the times have altered; and it is not the poor cottager who will dispute the justice of the cessation of these returns, especially when it is further explained that really the meter ought to be set to deliver a little less gas for the pennies, but that the company will for a time try to do without the additional money.

American Engineers in Westminster.

An interesting episode in the history of the growing brotherhood of the best humanity of all nations, was the holding last week, at the Institution of Civil Engineers, in Westminster, of the Annual Convention of the American Society of Civil Engineers. Sir Douglas Fox, the President of the Institution, welcomed the Americans, whose President is Mr. John F. Wallace. The party includes many engineers whose names are familiar to English readers of American technical publications. Mr. Wallace's Presidential Address was an eloquent plea for full recognition of humanism in civil engineering. Profound study of precedents, mathematical skill, command of all the tools of the profession, and high personal character to boot, are not enough to make an engineer. In the technical schools of the day, materials and forces are studied; but no attention is paid to "the mental and moral constitution of man, which is the "live material that engineers must use in fitting Nature's "raw product to the work in hand." There is too great a tendency on the part of engineers to regard their profession as essentially materialistic, to the exclusion of the mental and spiritual. "The prevailing law of matter is inertia. "The prevailing principle of the engineering profession is "life." The successful engineer is the man who can do

things. He is one "who, seeing a necessity arising in the "onward march of civilization, can think out its solution, "conceive a project, design the necessary works connected "therewith, and carry out the scheme as a whole to a "successful issue; at the same time convincing his fellow-"men of the necessity for the work, the efficiency and "economy of his design, and his own ability to accomplish "the desired result." These be inspiring words.

The whole address, indeed, is well worth reading as an example of good nervous English. It furnishes additional proof, if more were needed, that there is no American language, as the term is usually employed to characterize the barbarous lingo of the quarter-educated denizens of the United States whom one meets in the show-places of England. This is also the language in which most American newspapers are written; but men of the quality of the President of the American Society of Civil Engineers do not use it. There is not a single "Americanism" in the whole of his address, which is of the severest diction that ever came out of Oxford. This, however, did not prevent the speaker from tempering his more serious observations with a lambent humour, ever and again bubbling up into downright fun. Nothing could be smarter, for example, than the reference he made to Joshua as an early engineer who utilized his talents "in the overthrow of Jericho by "means of the theory of rhythmic oscillation."

Such re-unions as that of last week are the most helpful, hopeful form of Internationalism. Experience goes to show that, up to the present hour, the long-thought-of Brotherhood of Man can only be realized between men of different nationality who meet on the common ground of Science or Art. The Free Traders tried to put it on the ground of an enlightened self-interest; but the foundation was not stable enough. The religions of the world, of course, are hopeless sunderers. All attempts to internationalize Labour politics have failed owing to the preponderance of the element of locality. The artist is the more advanced Internationalist, because Art speaks all languages. Science, however, is one in her aim, which is the pursuit and the expression of Truth, albeit she must speak in various tongues. Yet there is one language in which the most practical branches of Science, which run at last into Technics, find the widest expression; and that is the noble tongue which is safely buttressed by the Authorized Version of the Bible on the one side, and by Shakespeare on the other. This is the language spoken by the President of the American Society of Civil Engineers in Westminster—think what this event implies!—last week; and he found it adequate to the enunciation of his lightest as well as his most impressive thoughts. If for this good speech alone, Mr. Wallace deserves to be honoured by English-speaking engineers the world over.

The Amelioration of the Lot of the Workman.

It is remarkable how slowly the industrial world adapts itself to the suggestions of enlightened experience in respect of those apparently minor and subordinate matters which make so much difference to individuals. Work and wages, wages and work—the changes ring quickly enough in these principal matters; but it takes some special event to prove the importance of the ancillary conditions of labour. An illustration of this is given by the abortive dockers' strike. One of the conditions sought to be imposed by the Trade Union leaders was that men should only be taken on for dock work outside the dock walls. This was the original custom; and, on the face of it, there would not appear to be a great principle involved in the perpetuation of the practice. It came out, however, that there was more in the demand than met the eye. Of course, the advantage to the men themselves did not enter into the leaders' calculations. Outside the dock gates there is no shelter, and no place for the men to go to besides the public-houses. But the leaders could "boss the "show." They could mark every man who offered himself for work, and in many ways make their power felt by both interests. Moved by these considerations, the employers have taken the not altogether amazing step of erecting a sufficiency of "taking on" sheds inside the docks. These are shelters and employment agencies, all in telephonic communication with one another. Here the men will gather at fixed hours, and receive their orders, without having to tramp all over the docks in search of jobs. How extremely simple and obvious—and what a long time, and how much trouble, it has taken to bring about this convenience! It is the little things, as they may appear to those who do not suffer from them, that make the lot of the working man unnecessarily hard. Some of them are mere superstitions—remanets from an earlier order of things industrial—which irritate men to the point of rendering them susceptible to the wiles of the agitator, who puts in one word for them and two for himself. In the army of industry, thanks to the absence of any hard-and-fast line of demarcation between the officers and the men, and to promotion from the ranks being frequent, most employers know what the men feel, and what they have to suffer. Where this common experience is missing—as in some of the rougher occupations in which employers are, generally speaking, of a totally different caste from the workpeople—minor ameliorations of the employment are long on the road. A convulsion is required to betray the need for them. So it is in the gas industry. It is the duty of the manager to penetrate through the screen that separates his ideas of what is befitting the state of manhood, from those in which the rough material at his hand has grown up in brickfields and all manner of lowly places. He has to do this unknown to the objects of his study, or he will be misled, and will fail to accomplish any good. He must also avoid everything savouring of patronage or fussiness; and he must often be thankful if he does not get kicked for his pains. Nevertheless, the duty is a duty, and it must be done. A little here, and a little there; so the original curse is lightened, and the wage-earner is helped to discover himself as a responsible being.

WATER AND SANITARY AFFAIRS.

When referring last week to the progress of the Staines reservoirs scheme, and its value in connection with the future water supply of the Metropolis, we confessed to not sharing the opinion enunciated by Sir Alexander Binnie, on the occasion of his becoming a Turner, that resort to a distant watershed will be necessary in the near future; and we ventured to suggest that the untapped sources of water in the valleys of the Thames and Lea should be utilized to their fullest extent before enormous expense is incurred in going to Wales. In using the words "untapped sources," we had in mind the conclusions arrived at by Lord Balfour's Commission, that in dry years a quantity of water up to a maximum of 40 million gallons daily might be derived from wells in the Lea Valley; that from the existing wells of the Kent Water Company, and others which might be sunk within their district, about three-fourths of that quantity might be safely taken; and that from the tract of chalk country in the valley of the Medway, and the larger area farther eastward towards the coast, a very considerable addition was also undoubtedly procurable. The Commissioners had the assistance of the most eminent geologists of the time to guide them in coming to a right conclusion on this matter; but they do not seem (nor do their successors under Lord Llandaff) to have been made acquainted with what the Americans would call the "bottom facts." To have been quite up to date, they should have had before them Mr. Walker Moseley, who, while our remarks last week were being printed, was telling the residents of Camberwell assembled in the Vestry Hall, some most astounding things in regard to London's underground stores of water. If the statements he made can be supported, the London County Council may carefully pack up the plans for their Welsh scheme, which they have prepared at so much cost to the ratepayers, and lighten their parliamentary expenses by abandoning its prosecution.

According to Mr. Moseley, we Londoners are living over a great subterranean lake which is capable of furnishing an enormous quantity of pure water for our use, if we only take the trouble to draw it. His theory is that there flows from the hills of Hertfordshire a great stream which enters the chalk strata below the London clay; and he thinks we shall be on the safe side in reckoning that the water always in reserve there amounts to something like 50,000,000 million gallons. This underground water he says does not belong to anybody; and if London could not obtain from this source all that it required, it could procure sufficient for the next fifty or a hundred years. He advises that systematic quantity tests should be made by some responsible public body—say the London County Council—by sinking twenty wells, which would, he says, furnish absolute proofs as to whether an additional 100 or 200 million gallons of water

could be relied upon, from the source he has indicated, for the service of the Metropolis. The net advantages he claims for this scheme (compared with the Council's Welsh project) are that an auxiliary supply of absolutely pure water would be obtained at a saving of somewhere about £20,000,000, while there would be no risk of interruption in the service, as would be the case in the event of damage to the aqueduct by a hostile force. If there is in existence beneath us the great store of water which Mr. Moseley makes out, it might be advisable to incur the expense of sinking a few borings to procure some of it, as at present only a little more than 20 per cent. of the total quantity supplied to London is obtained from springs and wells. But before operations are commenced, some special investigations should be carried out with the view of ascertaining how nearly Mr. Moseley's estimate of the available supplies approaches to accuracy. Boring for water is not always attended with the success originally contemplated. Work of this kind has been going on for some years at Richmond; and it might be well for Mr. Moseley, before he and the Committee formed to carry out his idea begin preparing any scheme for London, to procure the latest available information in regard to that undertaking. Meanwhile, he has received some sharp criticism from Sir Alexander Binnie, who disputes Mr. Moseley's figures; and we shall probably hear more from him. We may safely leave the question in Sir Alexander's hands.

The subject of the rating of water-works was so fully discussed in this column last week, in connection with the paper read by Mr. F. J. Bancroft at the recent meeting of the British Association of Water-Works Engineers, that we only revert to it now in order to call our readers' attention to the letter from Mr. H. Wilkins, the Secretary of the Lambeth Water Company, which appears in our "Correspondence" columns to-day. It will doubtless be remembered that at the close of his paper Mr. Bancroft alluded to a proposition put forward by Mr. Wilkins for placing on a simple and intelligible basis the system of rating public undertakings. The suggestion was made in a memorandum prepared by him for the Royal Commission on Local Taxation in 1897; and by his courtesy we are able to give it in another part of the "JOURNAL." It will be seen therefrom that, as mentioned last week, it consists in calculating the gross annual value of the property at a specified percentage on the rateable capital outlay, varying according to the amount of the gross profits, and making an all-round deduction of 15 per cent. in order to arrive at the rateable value. Mr. Wilkins puts a hypothetical case to illustrate the application of his suggestion; and it must be acknowledged that it has the merit of simplicity. He points out that the term "gross profit" means for his scheme the "divisible profit"—that is to say, the amount available for paying dividends on ordinary and preference shares and interest on the debenture and loan capital. In considering the application of his plan to undertakings earning only a small amount of profit, Mr. Wilkins points out that the works are rateable as long as they are occupied, though the business may not be remunerative. Occupation, not profit, is the proper test of liability to rates, and rental value is the measure of such liability. We may again commend Mr. Bancroft's paper and the report of the discussion thereon to the consideration of our readers, in conjunction with the addition to the literature of the subject which we are now able to present.

Among the members of the British Association of Water-Works Engineers, there are not two opinions as to the wisdom of preventing and detecting waste of water; and therefore Mr. A. J. Jenkins did not, by reading his paper on "The Relationship between the Cost of Water Wasted" and the Cost of Detection and Prevention of Waste," secure any new converts to what is a settled tenet of the true water-works engineer. However (while some of the figures which the author presented were a little out of date, and appear somewhat familiar), the paper has done good, first in placing upon record what has been accomplished in Cardiff in the direction of counteracting waste, and secondly in eliciting the latest experiences in other towns. Armed with the report which appears elsewhere in this issue, the water manager who is manacled by an indolent Board of Directors or Water Committee should have little difficulty in convincing them that there is such a thing as being "penny wise and pound foolish" even in the administration of the affairs of a water undertaking. On the general question, only a few words need be said. We should prefer to place in the forefront the prevention of waste, and advocate towards this end the best work in the distribution system and the best household fittings—regarding the system of detection as a necessary supplement for accidental and wrongful waste. Of course, in towns where the water authority have little or practically no power over internal water-fittings, or have not exercised the powers they do possess, this order of things cannot immediately be; but "prevention" being "better than "cure," that is the proper end to aim for. We may give Leicester as a model; and, in doing so, we anticipate the retort that Leicester and a few other fortunate towns possess powers which are now denied to water undertakings. But in reply to that we would ask, Have proper steps been taken to prove to the Legislature, as has been proved to water engineers, that the large powers conferred upon Leicester years ago have wrought beneficial results—results of a character that cannot be obtained by any other means? Steps have not been taken to show Parliament that these large powers would be generally advantageous; but, if there is a common desire for them, we fail to see any sound reason why, in the face of such evidence as Leicester can furnish, they should be refused.

There is another point that the discussion brought into prominence, and it is that water engineers have different views as to the value of the water saved by a system of detection. Some seem to think that only the bare cost of pumping and filtration should be estimated; while others are of opinion that the entire cost, such as sinking fund, interest, and working expenses—in fact, the exact expense of delivery to the consumers—is the sum for which credit should be taken. Both, under certain circumstances, would be fair methods of computing the value; and, to a certain extent, under other circumstances, both would be wrong. The whole matter resolves itself into a question of supply and demand. If the source yields a superabundant supply of water, then the value of the water wasted in the distributory system can hardly be worth more than the naked cost incurred in putting it into the mains; while if the supply is only safely adequate to meet the demand, then we should say the whole expense of delivery to the consumer would be the value of the water saved. But there are districts in which Nature seems to have been unmindful of the requirements of the inhabitants in respect of water; and in such places frugality has to be practised, and the water has to be sent out after a brief season of dry weather with a very sparing hand. In such places, we should say that water saved by a system of detection would possess a value far beyond its mere cost at the consumer's tap. Thus, in estimating the value of the water saved, it seems to us that no hard-and-fast basis can be adopted; the water engineer of each town must have regard to his own circumstances in making a computation. At the same time, whatever the value—whether it be large or small—let there be no waste.

The American Society of Civil Engineers held their annual convention in London last week; and they were the honoured guests of the Institution of Civil Engineers. Very naturally, the greater part of their stay was spent in pleasure; and yet they did not neglect altogether the more prosaic work of their organization. On two subjects of technical importance, the visitors exchanged views with their English compeers. In only one of them are readers of the "JOURNAL" intimately concerned, and that was the question of the filtration of public water supplies. There was nothing in the discussion calling for extended comment. It was chiefly interesting from the fact that it brings the information on the subject up to date; and it also gives us an insight into some of the difficulties which water engineers of other countries have to contend with in connection with the purification of water. America has lagged far behind in this important matter. But there has recently been an awakening; and there are signs that we may yet see the water engineers of that great country entering into filtration with all the enthusiasm of new-born converts. There is one lesson that they will have to learn, and that is that filtration and the terrible waste of water which now goes on in all parts of America will not go hand in hand. Information as to the best English, and the latest Continental, practice was given to the visitors; and in obtaining this, the object of introducing the subject was no doubt gained. Upwards of three hours were spent in discussing the question; but our report—necessarily much condensed—is unavoidably held over.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 109.)

THE unfortunate Stock Markets have gone from bad to worse; and last week was one of the gloomiest that Capel Court has seen for a considerable time. The state of things in China has upset everything; and black as it is, it really seems to be painted blacker than it need be. Of course, business was reduced to very small proportions; and dealers were chary of making prices. And when complete dislocations of the Berlin markets supervened, things here came pretty well to a standstill. That prices have had a material drop need scarcely be said; but it may be noted in illustration that on Thursday Consols touched 98⅝, and the War Loan fell to a discount. However, there was a slight recovery the next day; but the Exchange being closed on Saturday for a holiday, the rally had no time to proceed far. The Money Market ruled easy in the earlier portion of the week, but showed a disposition to harden later on when things began to look more awkward. Business in the Gas Market was noticeable for its irregularity more than anything else. On most days it was extremely quiet; but it broke out fitfully into some degree of activity now and then. And variations in quotation were irregular too—there being almost as many ups as downs; but none of them were of any considerable value. Taken all round, the general tendency was fairly steady. Gaslight ordinary was conspicuously so, changing hands daily at about 98¼, which was the figure at which the opening and the closing transactions of the week were marked. In the secured issues, the preference was very steady; but the maximum had to give way a point. South Metropolitan was quiet. The quotation was advanced a point-and-a-half; but there was nothing in the actual dealings to indicate any great access of strength. Nothing at all was marked in Commercials; but the debenture was put down two points. The Suburban and Provincial group were nearly torpid; but a low-priced bargain in Brentford new sent the quotation down. Among the Continental Companies, flatness was apparent in Imperial, which had the novel experience of being dealt in several times at a level 200. Of remoter undertakings, Oriental Gas was advanced; but Cape Town and River Plate were lowered. Business in the Water Companies was about as usual; and prices remained unchanged, except that there was a fall in West Middlesex.

The daily operations were: Business opened very sluggish in the Gas Market on Monday; but the tendency was pretty good. South Metropolitan rose 1½, and Oriental old ¼; but Commercial debenture receded 2. Transactions were livelier on Tuesday; but they were almost wholly in Gaslight issues. Brentford new fell 3, and Cape Town ¼. Business became quiet again on Wednesday; and quotations did not move. On Thursday also, there was general inactivity, coupled with some further reductions. Imperial fell 2, Gaslight maximum 1, and River Plate ¼. Friday was by far the most active day in the week, but with no change in Gas prices. In Water, West Middlesex dropped 5. The Exchange was closed on Saturday.

ELECTRIC LIGHTING MEMORANDA.

Dublin Again—The Corporation Victorious—Scandalous Tactics—The Case of Marylebone.

LAST week we mentioned the parliamentary squabble over the electric lighting of Dublin, which resulted for the time being in the discomfiture of the Corporation at the hands of Mr. T. M. Healy, M.P., who is understood to have a particular interest in the opposition to the Corporation Bill. Meanwhile, however, it appears that a political convention, in which Mr. Healy had no part, was being held in Dublin to signalize and ratify the reunion of all the Irish Nationalist Members of Parliament in one party. A reunited party with a number of individuals left out is, obviously, in strict accordance with Irish ideas. Anyhow, the leader of the so-called united party had the disposal of a number of votes in the House of Commons, simply by reason of his being in possession of the funds without which his followers could not travel to Westminster. The story goes that this puissant personage agreed, for a consideration, to convey his commando to Westminster for the third reading of the Bill which had the advantage of Mr. Healy's support, and therewith defeat it. At any rate, when the third reading came on there were many more Irish members in the precincts of St. Stephen's than had been seen there for a long time; and the Bill was lost on the division by a majority of six. Next day Mr. H. W. Lucy informed the readers of his "Pictures in Parliament" in the "Daily News," that the "lobbying" against the Bill exceeded anything in recent experience. But there seems to have been something more afoot than what is commonly understood by this term. Mr. Lucy goes on to state that "it is said that one prominent advocate of the privileges of the Corporation and the interests of the Gas Company received a fee of 200 guineas for his attendance in the lobby."

The guarded nature of the above allegation is to be noted. The astute reporter does not say that any member was paid for his vote; but only for attending in the lobby, which, of course, is no part of his parliamentary duty. The distinction, however, is a very thin one, as it was doubtless meant to be. The real point to be noted is that something material happened between the report stage and the third reading to change the fortunes of the Bill promoted by the extra-Corporation interests. It will be observed with some surprise by our technical readers that the lobby hand of the "Daily News" has linked the name of the Alliance and Dublin Consumers' Gas Company with that of the Corporation as party to the resistance to the Bill, which, without serious error, may be described as the Bill of the Tramways Company. This conjunction must appear remarkable and unaccountable to those who only know the same parties as irreconcilable foes, for ever fighting in the Irish Courts over questions arising out of the public lighting of Dublin. What is the reason, it may be asked, for joining these inveterate enemies as being in the same galley on this memorable occasion? The answer is that it is all a point in the interminable, wearisome game of Irish Nationalist politics. Mr. Healy, in his genial way, told the House of Commons that the Gas Company own the "Freeman's Journal," which supports the Corporation; and he argued that, consequently, there must be some immoral compact in existence between these interests, with the object of keeping the electric lighting of the city in the hands of the Corporation, who will do it badly, and of preventing it from being undertaken by the Tramways people, who would do it well. He himself, as a matter of fact, is interested on the tramways side; but that is a detail. The noteworthy point of all this yea and nay business in the House of Commons is the unblushing way in which interested motives are ascribed and admitted on all sides. Municipal trading, when thus mixed up with professional politics, does not present an inviting aspect. In this Dublin case, the last thing to determine the issue seems to be the interest of the inhabitants and ratepayers of Dublin.

Another parliamentary fuss, not quite so odoriferous, arose over the second reading stage of the Marylebone Electric Lighting Order Confirmation Bill. This measure would have confirmed an Order admitting into the parish of St. Marylebone a second Electric Lighting Company to compete with the existing one. The circumstances are peculiar, and illustrate how difficult it is to arrange this class of business upon general principles. The Company in possession of the area is the Metropolitan Electric Supply Company; and it is alleged that the Company has not dealt fairly with the Marylebone district, which is only a portion of their wide dominions. Two years ago, the Marylebone Vestry offered to go into electric lighting on their own account; but this project was rejected by Parliament on the general plea that a local authority should not compete in business with a private undertaking. The practical results of this decision, sound enough in principle, were decidedly awkward. Limited competition in electricity supply is expressly encouraged by the Electric Lighting Act, without distinction of persons. All experience goes to show, moreover, that in competition lies the only real protection for the public against monopolistic greed or incompetency. It would have been quite in accordance with the spirit of the Electric Lighting Act if the Vestry of Marylebone had been allowed to compete with the Metropolitan Company; and so the House of Commons thought, for the Bill of the Vestry passed the second reading. It was thrown out by the Committee, however; and there the matter rested. Meanwhile, the service performed by the Metropolitan Company went from bad to worse; and the only possible remedy seemed to lie in the admission of a rival Company working a different system. This expedient, however, did not commend itself to the Vestry; who objected to having a second private undertaking thrust upon the district at the very inopportune juncture when the Vestry itself is about to disappear and make room for a Municipal Corporation of Marylebone. This objection pretty plainly showed that the complaint against the local Company was merely a preliminary to the launching of a new and enlarged scheme of municipal action, and that the alleged necessities of local users of the electric light are not a principal consideration in the counsels of the Vestry. If better lighting had been all that is desired, this Bill was the way to procure it. But that was not what the Vestry wanted; and accordingly they managed to get the Bill rejected on the second reading.

JUDGE PARRY ON THE WORKMEN'S COMPENSATION ACT.

THE modern, and by no means admirable, practice of judges criticizing as well as administrating the laws of the country—and especially the Workmen's Compensation Act—appears unfortunately to be growing. We are constantly seeing in the Daily Press that His Honour Judge So and So, of such and such a County Court, expressed the opinion that the Workmen's Compensation Act is the "worst drafted measure in the Statute Book," &c., &c.; and now we find His Honour Judge Parry, of the Manchester County Court, contributing an article to the "Fortnightly Review" condemning the Act in no gentle terms. Leaving on one side the question of the propriety of judges taking upon themselves to express their opinions upon the utility or otherwise of the laws they are appointed to administer, let us see what there is in these judicial criticisms when they are put into writing, and not merely confined to generalities from the bench. It might well be asked, in passing, whether there may not be some connection between these criticisms (or mere swearings at large as they frequently are), coming as they do

from county court judges, and the fact that the passing of the Act necessarily imposed a considerable amount of extra work upon these functionaries?

Judge Parry commences his article, which is entitled "The Workmen's Compensation Act: What it Was to Be, and What it Is," by quoting some words of Mr. Asquith as stating, with sufficient clearness, the principle which the Legislature has sought "to crystallize into the form of statutory perfection." This principle is that, "When a person, on his own responsibility and for his own profit, sets in motion agencies which create risks for others, he ought to be civilly responsible for the consequences of his own acts." This is what Parliament, with the best of goodwill, intended to enact; and, according to Judge Parry, Parliament has failed so to do. His Honour repeats the favourite, and somewhat hackneyed, taunt of that section of the Press that loves not Mr. Chamberlain, about the Act which was to obviate the necessity for litigation having already given rise to so many actions and appeals—the unfairness of which allegation we have more than once demonstrated—and founds his other main criticism of the drafting of the measure upon the contention that, as interpreted by the Law Courts, the Act really retains what the Legislature meant to abolish—namely, the defence of "contributory negligence" as a plea enabling the employer to evade payment of compensation. This is said to arise from the interpretation by the Court of Appeal of the first section of the Act. The section provides that a man shall be compensated for accidents "arising out of, and in the course of, his employment." "It is clear from the debate," says Judge Parry, "that this was supposed to be a legal and periphrastic way of saying 'during the employment,' or 'while in the service of;' but the Court of Appeal construed the words to mean strictly what they said. . . . This is, of course, a serious blow to the Act as a Compensation Act. It really introduces something very like our old friend 'contributory negligence, in a new dress." But does it? That is just the point.

The defence of contributory negligence was one which pleaded that the injured man, while in the performance of his duty, met with his accident owing, in part, to his own negligence in the manner of his performance of that duty. The first section of the Workmen's Compensation Act, as literally construed, merely provides, on the other hand, that to be entitled to compensation, the injured man must be proved to have met with his accident while performing his duty. If that be proved, the only defence that can avail to prevent him receiving compensation is that he was guilty of "wilful and serious misconduct." Judge Parry would have us believe that Parliament intended that if a man met with an accident while doing something which he had not been told to do, or had been told not to do by his employer—something quite apart from the duty for which he was engaged by his employer—he should unquestionably be compensated by the employer. That, His Honour apparently thinks, is a true interpretation of the principle he enunciates at the beginning of his article, and which we have already quoted, that, "when a person sets in motion agencies which create risks for others, he ought to be civilly responsible for the consequence of his own acts"! Is it really suggested that if an employer engages a man to do one thing in his workshop, and that man chooses to do another (in the course of which proceeding he is injured), that that accident is a "consequence of the act of the employer"? It would be as sensible to argue that the man who planted a tree should compensate another who, of his own accord, climbed up it, and then fell down and broke his leg, on the ground that the accident to the second man was a consequence of the act of the first.

The Judge's contention is that Parliament meant to pass a "Compensation" Act, but that the measure as interpreted is only a "liability" Act, and that the alleged immoderate bulk of litigation which has arisen out of the interpretation of its provisions is due to this fact. He is of opinion that the ideal—of an universal compensation for all accidents in certain trades, automatically paid to all except those guilty of serious and wilful misconduct—is most nearly realized in Germany, where the Accident Insurance Act "provides for compensation for all disablement or death arising from any accident which may occur during work from any cause, even when occurring through negligence (not for accidents when away from work)." But does this provision bar all chance of litigation? When is a man away from his work, or when does he reach it?

It has been a subject of remark that most of the critics of the Act and its authors, so far from condemning it *in toto*, make it one of their chief points of criticism that the Act, faulty as they declare it to be, does not extend to all trades. Not so, however, Judge Parry. "I have," he says, "the gravest doubt if the present Bill can be in any useful way amended, except in so far as abolition is amendment. However it were simplified, I fear words would be left in it giving the Courts a chance of construing a contributory negligence defence into the amended Act; and if there were such words, the original sin inherent in all lawyers would ensure their coming to the surface and being judicially considered by minds trained to discover defences." Without sharing in the pessimistic view of the value of the Act, expressed in the foregoing, it is possible to appreciate the truth of the Judge's estimate of the ingenuity of the legal fraternity.

It is but fair to the writer to remark that his criticisms are not all of a negative character, nor his opinions hostile to the principle of accident compensation. He wants, he says, greater certainty of its assurance to the injured; and he outlines, though very vaguely, a scheme of his own for effecting that assurance. "I should like to see the whole machinery taken away from the Law Courts altogether. What is wanted is a scheme rather than an Act of Parliament—a scheme in which, if the County Court machinery is used, it is only to be used for the purpose of fixing compensation, and then calling in the Post Office to aid in distributing the funds. A scheme in which the appeals, if any, are to be to some body like the Railway Commissioners, business-like as well as technical. . . . . No scheme will succeed that does not abolish the form and spirit of litigation, and is not governed in its ultimate Court of Appeal by men desirous of assisting to form a working scheme, rather than by lawyers whose duty it is to ingeniously construe what may be put before them. . . . . A small Committee, consisting of a colliery manager, a works manager, a Trades Union official, an insurance manager, and a County Court Registrar, could, among them, thrash out something workable. If this was not choked by departmental rules and orders, and if Parliament would accept it, and it were kept out of the hands of the lawyers afterwards, it would be found possible to realize the ideal set forth in the debates on the Workmen's Compensation Act."

We have quoted somewhat fully, because, in spite of the subjunctive and nebulous character of his proposals, there is some force in Judge Parry's plea for the decision by men of business, rather than by lawyers, of questions arising between employer and employed over the right to, or amount of, compensation. But a very strong case would have to be made out before Parliament would consider the question of recasting a system which is only just shaking down into working order—the obvious need for such a period of shaking down is what partisan critics deliberately ignore—and Judge Parry does not make out such a case. He, moreover, takes no account of the provision in the Act whereby masters and men can, by mutual agreement, do just what he proposes to do—namely, substitute a scheme for the provisions of the Act.

The whole explanation of Judge Parry's altogether mistaken views on the value and workability of the Compensation Act lies, we think, in a failure on his part to appreciate the true perspective of the question. His Honour, sitting in the Manchester County Court, naturally sees little but the litigious side of the Act; and he fondly imagines it to be the only side. Otherwise, he could not make such statements as he does when he speaks of the Act as one the passing of which "has been so unfortunate to all classes of the community, except lawyers." Let him take a piece of paper, write down on one side the total number of accidents (fatal and non-fatal) in the course of a year, and on the other the number of cases of litigation under the Act in all the Courts—not including, of course, County Court arbitrations, which are not of the nature of litigation, merely of administration—and then ask himself whether the existence of the Act is really an unmitigated misfortune to the working-classes. What should we think of the magistrate who judged all the world to be no better than the samples submitted daily for his inspection? Yet, apparently, Judge Parry takes no broader view of the Act he has to administer and thinks fit to criticize.

MR. T. W. ALDWINCKLE ON VENTILATION—A WORD FOR GAS LIGHTING.

During the present season the members of the Architectural Association Discussion Session have had before them a paper by Mr. T. Wilson Aldwinckle, entitled "Warming and Ventilation." It is always a matter for congratulation when members of the architectural profession deign to take cognisance of practical subjects affecting the conditions under which people live, and thus prove that the soul of the architect is not wholly absorbed in the consideration of elevations, sky-lines, and mouldings. The subject chosen for Mr. Aldwinckle's discourse is, of course, far too large to be thoroughly treated in a single paper; but the limits of a paper are quite sufficient for setting out the main lines of the most improved practice in this regard. It must often strike the assiduous reader of technical papers, that the proper character and uses of this class of literary compositions are not always understood by the professional men who occasionally write them—especially when this task happens to be undertaken by request, and to oblige the author's good friend, "the Secretary." It is perhaps because of this misunderstanding that so many papers written to order seem to partake so much of the nature of the boiled-down text-book. Now text-book information is very well in its place, and it may often be used very properly as the datum for a paper; but it is out of place in the paper itself. Speaking very generally and broadly, a technical paper may permissibly, and properly, be of the nature of a supplement to the text-book and to any previous publications dealing with its subject. When a professional man undertakes to write a paper upon "Gas Lighting," or "Warming and Ventilation," as in the present instance, it is never worth his while to hash-up a mass of old matter, much of which has probably never been experimentally verified. That kind of exercise is only fit for students, who should not attempt anything more than abstracting. It is essential to a good professional paper that the author, if he has nothing original to put

forward, should at least bring his matter up to date—which, by its very nature, a text-book cannot do.

With this standard of criticism in view, therefore, we approach Mr. Aldwinckle's paper with all the respect owing to the Architect of the Brook Green Hospital. Those who follow us in the study of this excellent little memorandum on a great subject, will not regret their trouble. The text was published in the "Builder" for April 21 last. The author's initial definitions of good ventilation and good warming are unexceptionable. He defines the former as "the efficient, constant, and uniform change of air without draughts, by which pure air is substituted for foul;" and the latter as "the efficient, constant, and uniform maintenance of temperature, whatever may be the temperature of the atmosphere." This is very engaging, to start with, impressing the reader with a sense that the writer knows what he wants, which is the first stage towards getting it. When Mr. Aldwinckle gets at the general conditions of ventilation, also, he shows that he is well grounded in the physics and chemistry of the subject. He lays hold of the carbonic acid as the chief impurity of vitiated air to be dealt with by ventilation; and he observes that, although this gas is about half as heavy again as air, by the law of diffusion of gases it is equally diffused throughout the atmosphere. The usual run of ventilating engineers are accustomed to assume that the carbonic acid, being heavier than air, will always fall to the bottom of an occupied apartment. Mr. Aldwinckle, moreover, does not overlook the fact that carbonic acid gas, as it comes off in exhaled air or in the products of combustion of gas used for lighting, is so much warmer than the atmosphere that it rises, and if it can be carried off before it cools and falls, or by diffusion gets mixed with the general atmosphere of the room, the air in the room will not retain more than its normal proportion of carbonic acid gas, and of the organic matter in suspension and excess of aqueous vapour always associated with it. He therefore quickly sums up by saying that efficient ventilation has to remove the various impurities which come into the air, and to supply fresh air to take the place of the foul, to the extent of between 2000 and 3000 cubic feet per hour for every person, which is the amount required by a person in full health. The question of warming is naturally bound up with that of ventilation.

Mr. Aldwinckle makes the usual and necessary division of ventilation into the natural and the mechanical systems, and further subdivides the former into automatic and assisted natural ventilation. The first comprises the normal operation of all inlets and outlets. The second includes the natural current of air through inlets and outlets, assisted by some mechanical means, though by no means "mechanical ventilation" in the full sense. Of such are the gas-jet burning at the bottom of an exhaust air-flue to induce the upward current of the vitiated air, or small fans working near the ceiling to cause a quicker travel of smoke or fumes towards the outlets. The author remarks that there is almost another subdivision of natural ventilation—the cases where permanent arrangements, such as louvres, are relied upon to provide the constant access of air to interiors. It is not obvious, however, why this common device should be erected into a distinct class.

With regard to mechanical ventilation, whether by the plenum or the vacuum system, with the regulated admission, washing, warming, and distribution throughout the building of the requisite volume of air, Mr. Aldwinckle observes that, while the theory is excellent, the practice leaves much to be desired. He dislikes the principle, because he has great faith in the open window in a climate like ours, and an open window would destroy any such system. Besides, the few leading instances of complete mechanical ventilation in this country are not altogether successful. The Houses of Parliament and the Royal Courts of Justice are awful examples of "how not to do it" in the matter of ventilation. This business is better done in the United States; but there it is a sheer necessity. For this country Mr. Aldwinckle's advice is to avoid both plenum and vacuum systems of mechanical ventilation, unless circumstances compel. Oddly enough, he has been constrained to accept the inevitable himself in the provision to be made for ventilating the first-class swimming baths of the public baths and washhouses now being erected for the Vestry of St. Pancras.

In the case of what is usually posed as the simplest exercise in ventilation—that of a private dwelling-house—Mr. Aldwinckle takes the contrary view that this is an exceedingly difficult problem, owing to the morbid dread so many people entertain of draughts. His first prescription is the familiar one of the deep inside bead on the wood sill of all double-hung sashes, so as to enable the lower one to be raised slightly and air admitted in most weathers at the meeting rail. He recommends the addition of tobin tubes, and of air-shafts in the chimney breast, with admission from the top of the room. Mica flaps leading into the smoke-flue he will not have, on account of their noisiness and invariably going wrong after a few weeks' use. Unfortunately, the author was obliged to hurry over this branch of the subject; and accordingly his treatment of it is very inadequate. He wisely recommended the use of a warm-air stove in the hall, which is really indispensable if a house is to be kept from being downright chilly, in hard weather. He did not even mention the enormous difficulty of avoiding cutting draughts along the floor when roaring fires are kept up in open grates. The consideration of the case of sleeping rooms led the author by an easy transition to the ventilation and warming of hospitals, which he advised should be treated as far as possible on the principle of the open window. The same with schools. Of course, in the case of large wards and school-rooms additional air-inlets are required to supplement the windows; and these Mr. Aldwinckle would always place at the floor-level. The air would pass over radiators put in action in cold weather. The air-outlets, opened out from the ceiling level, are to be kept going by means of gas-flames. The extraction of air at the floor-level is at the same time to be provided for by the open fireplaces. Churches, theatres, and public halls are to be dealt with in practically the same way, by radiators and fan-driven currents of air, because they share the common characteristic of not having the help of fire-place ventilation. Lastly, Mr. Aldwinckle recognizes the extreme value in difficult cases of fans driven by electric motors. These appliances have cured many cases of bad ventilation previously regarded as hopeless. These fans are used to ventilate the Royal Courts of Justice; and those who have had business in the Courts this year, must have gratefully noticed the very great improvement that has been effected in their atmosphere. Whereas under the old system the air of the Courts became simply poisonous by the middle of the afternoon, now they are quite breezy—as the careless bystander will be apt to discover if he loiters too long by the end of the benches, where the fresh air is being driven in at the floor-level.

Mr. Aldwinckle is to be congratulated on his avoidance of the hackneyed commendation of electric lighting for crowded interiors as a means of remedying imperfect ventilation by diminishing the fresh air requirements. He probably knows full well that, where there are crowded assemblies, the need for adequate ventilation is independent of the method of artificial lighting. On the other hand, he might have said with truth that the general adoption of the incandescent gas-burner in private houses has revolutionized the conditions of aerial sanitation wherever the system of lighting has penetrated. Where the householder habitually used a three-light gas-pendant, with flat-flame burners consuming gas at the rate of 5 or 6 cubic feet each per hour, in a little, close room 11 or 12 feet square, and under 10 feet high, he now gets a better light from a single incandescent burner consuming less than 3 cubic feet of the same gas per hour. Not only does he spare his pocket thereby, but he also avoids spending his evenings in a gas-oven. Whereas the temperature and the condition of the air near the ceiling of such a room were, under the old system, obnoxious to the health of all the inmates, the single incandescent burner consumes so little gas that the sanitary objection to all "lights of combustion," on account of their competing for air with the human occupants of the room, sinks into insignificance. So far as the heat and the "fumes" are in question, nobody would detect the existence of such a gas-light in any ordinary room; and the gain to health from this cause alone must be very considerable.

DEVELOPING THE BENEFITS AFFORDED BY THE PATENT OFFICE TO INVENTORS.

Among the various and sundry questions which the "Journal" has a habit of treating upon independent lines, occasionally running counter to the popular opinion of the hour, that of the merit of English Patent Law and the practice of the Patent Office is conspicuous. While freely admitting that both the law and the office practice, being mere human devices, are open to improvement in several respects, it has been persistently and consistently maintained in these columns that most of the condemnation sometimes very freely poured out in the newspapers upon the English patent system is undeserved. Not to go further into this argument for the present, it is, at least, only doing common justice to the Board of Trade to recognize the willingness with which this Department entertains all reasonable suggestions for the development of the work of the Patent Office. There is a Committee now inquiring into certain suggested extensions of the work of the Office, for the benefit of patentees; and within the last week or two the report of an earlier Committee, appointed so recently as last November, "to consider various suggestions which have been made for developing the benefits afforded by the Patent Office to inventors," has appeared as a parliamentary paper. Although the labours of this Commitee were directed to investigating questions of detail in connection with the routine work of the Patent Office, and had not, like the present one, to consider and advise on questions of principle, the interest of the report is considerable. The suggestions dealt with relate to the acceleration of the completion of the classified illustrated abridgments of specifications anterior to 1884; the sub-divison and re-arrangement of the matter in the volumes of abridgments so as to facilitate searches; the issue of reminders for payment of renewal fees; the reprinting of specifications of expired patents; the opening of deposit accounts for Patent Office publications; and the increase of the annual allowance for the purchase of books and for binding for the Patent Office Library. These are all matters of high practical importance.

Taking the question of abridgments first, it is estimated that by the end of the year there will be about 340,000 British specifications of patents, ranging from the year 1617 to date. Most of this enormous crop is the growth of recent years. In

1856, when the specifications only numbered 25,000, the practice was commenced of preparing short abstracts of selected specifications, called abridgments, which were classified with reference to their subject matter. Collections of these abridgments, which were never illustrated, were published; but the work was partial, and otherwise incompletely done. Under the Act of 1883, the duty of publishing an Illustrated Patent Office Journal was laid upon the Controller; and five years later the present system of illustrated abridgments was established. For the sake of convenience, the work of making these abridgments has been divided so as to deal with the specifications by periods of seven years. As searchers among old patents know, the work as regards different periods is in different stages—that for the earliest being the most backward. The later abridgments, covering the periods from 1884 to 1892, are completed and published; and the still more recent ones are being finished in accordance with the newest office rule—that publication of the illustrated abridgments shall be as nearly as possible concurrent with the acceptation of the specifications themselves.

The suggestion that the Committee had to deal with was for the accelerating of the illustrated abridgments of about 95,000 old specifications. The first question to be settled was as to the existence of a demand for this information, which was easily answered in the affirmative. The Committee were assured that many of the old specifications are of great practical interest, and that a large amount of useful information would be much more readily accessible to the public if the old specifications were abridged on modern lines. And, of course, in searching for anticipations the old specifications are of as great importance as any. Moreover, some of the old unillustrated abridgments are of little value; and the subject-matter indices are, in some years, very poor. Consequently there was a strong case made out for the uniform treatment of all the old specifications in the style of the later abridgments, the utility of which was warmly acknowledged by the witnesses heard on this point by the Committee. Having regard, therefore, to the general expediency of giving the fullest facilities to searchers, the Committee recommend that illustrated abridgments of all the old specifications from 1617 to 1883 inclusive should be put in hand and completed with all reasonable despatch. It will be the end of 1906 before the last division of this work—that embracing the period from 1617 to 1866—will be finished.

When the abridgments are all published, for their respective periods, in separate volumes for all the 146 classes into which the subject matters have been divided, these will constitute an unexampled technical library of 1022 volumes, the existence of which may be expected to very considerably influence the nature of the historical portions of future text-books. More than this, the reproach of ignorance of the subject ought to be very materially removed from the meritorious poor inventor of the future. Few persons who know enough to make application on their own account for a patent, are absolutely devoid of some technical instruction. It should be a standing order for those responsible for imparting this instruction not to fail to impress upon their classes the desirability of correcting any notions for inventions that might occur to them by consultation with the old patent specifications. The volumes will be cheap to buy, and handy for home use; and, in addition, there are already about 300 places in the United Kingdom where these books are daily accessible to the public for reference or copying free of charge. It is not asking too much of the poor inventor to suggest that he may often save his money, and spare himself and others a vast amount of unnecessary trouble, by taking advantage of this means of instruction.

But this copious source of information is to be made yet more accessible to the home student, and more convenient for the specialist, by further sub-division of the classes and a tentative rearrangement of the subject matter. At present, some of the classes are rather too comprehensive, which makes them unwieldy. For example, Class 28 includes inventions relating to "cooking and kitchen appliances, bread-making, and confectionery." One scarcely knows what to expect to find in such a grouping. Consequently, the Committee have had an experimental sifting out of these inventions, arranged not in septennial periods but ranging over the entire period for which the abridgments have already been prepared. The idea is that if it were feasible to sub-divide each of the present 146 classes into seven sub-classes, and publish in one volume all the abridgments belonging to every sub-class from the beginning down to 1900 inclusive, this would put the purchaser of one volume in possession of all he wants to know about a particular line of inventions. Otherwise, he must consult seven volumes, and pick out his speciality from numerous (to him) indifferent abridgments.

All the experts consulted favoured this proposal. They thought it would be valuable for a rough search before making an application. This was the patent agents' view of the suggestion. It was also remarked that such special publications should be of great utility to a would-be inventor with an "idea." If he knew next to nothing of what had already been patented in the same class—the normal condition of the amateur, and often the case with the instructed—he would have in such a book the best of mentors. But, of course, the expense of such selections and publications would be great; and the Committee were neither prepared to go into this question of the cost nor to recommend such publication. All they recommend, therefore, is a proceeding in this sense by way of experiment. The Comptroller-General is to make a selection of a limited number of leading subjects of invention, and the volumes of collected abridgments are to be placed in the Patent Office Library, but not reprinted without further consideration of the subject. The Comptroller-General will then, in the course of a few years, be able to readily gauge the quantum of the use which is made of the volumes. It is greatly to be hoped that his judgment will be favourable to the extension of the system.

On the question of official reminders for payment of patent renewal fees, the Committee give a negative answer. On the whole, they consider that the grievance sought to be remedied in this way is not far-reaching, and that the objections to the suggestion to send out reminders are more weighty than was at first realized. In regard to the reprinting of specifications of expired patents, the Committee think it would be of public benefit if the Comptroller-General had authority to reprint specifications for which there may be a demand. Steps are also to be taken, as far as possible, to guard against the abuse of buying up all the remaining copies of a particular specification for private reasons. The other recommendations of the Committee are not of a public character.

Altogether, therefore, it must be allowed that the appointment of this Departmental Committee was well justified. All their recommendations go to strengthen the hands of the Comptroller-General, and to make the Patent Office staff still more useful to the public. Throughout the report there is in evidence an implied confidence in the establishment which must be in the highest degree grateful to the able public servants who constitute the staff, and who are by no means too well paid for their difficult work. Whatever may be urged against the system, efficiency and regard for the public interest are a tradition of the Office. Unlike the Post Office, as to which it is frequently observed that the heads of departments seem doubtful whether the service exists for the public, or the public to maintain the service, the Patent Office has always kept in view the principle that all the officials from the highest to the lowest are public servants; and there have rarely been instances of arbitrary or inconsiderate official interpretations of the rules and regulations. Consequently, the large trust which the report of this Committee reposes in the discretion of the Comptroller-General is not misplaced. It is certain that no other national patent office is worked with so little friction between the officials and the public with whom the business of the office is done as that which is now under the control of Mr. C. N. Dalton, C.B., who succeeds a line of equally capable and devoted administrators.

THE GAS SUPPLY OF BOSTON (MASS.).

THE strange vagaries—the financial manipulation of gas undertakings at the hands of the "boss"—that have characterized, and do characterize, American gas politics, have often received attention in the columns of the "JOURNAL;" and it has been the subject of surprise on the part of English managers that the gas industry should be able to exist, and even thrive, in the atmosphere of glorious uncertainty which surrounds its conduct on the other side of the Atlantic. The condition of affairs in the States generally, may be described as unlimited competition, *plus* municipal corruption. The one State in which any serious attempt to put the gas supply upon a reasonable basis, by providing the investor with a fair amount of security, is that of Massachusetts. In that State, however, affairs are even now in a by no means perfectly satisfactory condition; while in the past they have been very specially the reverse. In recent numbers of the "Quarterly Journal of Economics"—published by the Harvard University—Mr. J. H. Gray has traced, with the utmost fulness of detail, the history of the Gas Supply of Boston; and the story he unfolds is, to English readers at least, so illuminative in respect of American financial methods as applied to gas undertakings, that we propose to give an abstract of the more important particulars set out in the articles.

The essence of the difficulties besetting the gas industry in the United States is explained at the outset. The belief that competition works advantageously in the supply of gas and similar services has, we are told, long been abandoned by careful observers on the other side of the Atlantic; but the general economic ignorance of the mass of voters, played upon by interested promoters and speculators, has prevented the legislative world from accepting the doctrine of monopoly in this industry. The fact that the gas business is highly technical, gives, according to American practices, an excellent opportunity for the companies conducting it to keep their accounts secret, and then make vague claims as to the cost of manufacture, and as to the importance of new inventions or processes. From these, and from the evils of municipal corruption, the city of Boston—though one of the most enlightened communities in America—has by no means been exempt. Indeed, its experience thereof has been extensive, if not exactly peculiar. This is how that experience is referred to by Mr. Gray: "So far," he says, "as my observation goes, no other single portion of municipal experience shows in such glaring light the weakness of American Governments, and at the same time illustrates so many important phases of the problem of the management and control of private corporations, as the history of the Gas Supply of Boston, and the manipulation of the stocks and debts of the Companies engaged in it." That, by anyone acquainted with American

municipal history, will be considered a pretty sweeping condemnation. Mr. Gray, as we shall presently see, certainly supports his assertions by some remarkable evidence. He proceeds: "The handling of Boston gas securities by foreign (*i.e.*, extra-State) corporations, organized expressly for that purpose, makes a distinct and remarkable chapter in the development of the business corporation and trust. The history of the financing of these Companies, with all their evasions and circumventions of law, is doubly interesting in view of the fact that Massachusetts is recognized as second to no State in the Union, either in the intelligence and high character of her citizenship and her legislature, or in the care with which she drafts and enforces her laws. The fact that these things go on in Massachusetts, is noteworthy also from the fact that she alone of all the States has established an able, honest, and permanent State Commission, whose duty it is, not only to see that the Gas Companies conform to all the laws of the State, but also, with a very wide discretion, to protect the consumer against wrong and injustice where no law protects him." Mr. Gray adds that it is only fair to say that the events which he relates in his articles began before the Gas Commission was established in 1885; but they have continued, and mostly happened, since that date. The attempts of the State to make the control of the Gas Companies effectual, are, however, admitted to include "not only some of the most interesting, but also some of the most promising experiments in the annals of the American commonwealths."

From these introductory remarks, Mr. Gray proceeds to recount and discuss the most noteworthy points in "this exceptionally unique history;" and we propose to summarize his account of the development of the gas supply of Boston. The Boston Gaslight Company was incorporated by Special Charter in 1822, with a capital of $75,000, and commenced to supply the city proper with gas in 1836. The undertaking grew until, in 1874, it had a paid-up share capital of $2,500,000, at which figure the capital stands to-day; the further authorized sum of $1,000,000 remaining unissued. In 1861, the office of State Gas Inspector was created, and official examination of gas for illuminating power and purity was commenced in the State. By a general law, of 1868, Gas Companies in America are required to sell new issues of stock for cash, and not below par, and to pay dividends in cash. By the Act of 1873, all Companies are obliged to sell new stock by auction.

From time to time, new Companies were chartered by the State with the right to supply gas in Boston and its suburbs, subject to the consent of the Local Authorities controlling the streets; but, up to 1884, no actual competition took place—the new Companies, by mutual arrangement with the original Boston Company, leaving the latter in possession of the city, in return for the privilege of buying up its mains and taking over its business in the suburbs. This continued until, in 1874, the gas supply was in the hands of the following Companies:—

	Paid-up Share Capital.	Miles of Main.
Boston Company	$2,500,000	105
Charlestown Company	500,000	25
Roxbury Company	600,000	48
South Boston Company	440,000	21
East Boston Company	220,000	10
Jamaica Plain Company	173,000	18
Dorchester Company	400,000	33
	$4,833,000	260

There was also in existence, but not in operation, the Brookline Company, with a capital of $350,000. The Boston Company were selling 612 million feet of gas at an average price of $2·39 per 1000 cubic feet; the others, in the aggregate, 231 millions, at from $3 to $4 per 1000 cubic feet. All the Companies were paying from 8 to 10 per cent. dividend; and the Boston Company, in particular, were year by year increasing their plant out of revenue.

The cheapening of manufacture, through the introduction of improved methods and the growth of the population, about this time brought other would-be competitors into the field; and, in 1874, a Company was actually organized, with a capital of $1,000,000, and applied for the right to supply. After very lengthy public hearings—preceded by loud denunciations of "monopoly," and a promise of two-dollar gas if the petitioners were allowed to compete with the "ultra conservative and antiquated" Boston Company—the aldermen of the city refused the petition of the new Company. As the result of continuous agitation for the admission of competitors, however, a Commission was appointed in 1877, to consider the whole question of the city's gas supply. This Commission, in their report, "showed the impossibility of effective competition, set forth the necessity of monopoly, and recommended control of the monopoly, through strict publicity of accounts, by means of an independent and impartial Commission. While not endorsing public ownership as a desirable solution of the problem, the Commission recommended that the city should seek authority from the State to establish its own gas plant, as a menace to bring the Companies to terms and keep them in check until permanent and effective means of control could be perfected."

Matters remained as they were for the next seven years—during which period the process of water-gas manufacture was discovered—until, in 1884, Mr. J. E. Addicks, of Philadelphia, turned his attention to the Boston gas supply, appeared upon the scene "fairly loaded down with water-gas patents," and formed the Bay State Gas Company of Massachusetts, with a capital of $500,000. This Company were granted leave to supply gas in the city, conditionally upon their undertaking to actually parallel all the mains in Boston. This condition the Company accepted, without the slightest intention of fulfilling it; the whole aim of the promoter being to consolidate all the existing Companies, and supply water gas. This was clearly proved by the fact that, as soon as ever they had obtained the right of supply, the Company began to erect enormous water-gas plants, and to lay mains designed to couple up the existing distributing systems; and this in spite of the fact that, in 1880, the State had passed an Act prohibiting the sale of gas containing more than 10 per cent. of carbonic oxide, and that such a combination as that contemplated was prohibited by the general laws of Massachusetts. They also continually petitioned the Legislature for power to increase their capital to $5,000,000, amalgamate with the existing Companies, and supply water gas.

The old Companies, fearing the competition of the cheaper water gas, and not desirous of amalgamation, used all their influence to defeat the projects of the new Company; and, finally, in 1885, they carried through the Legislature a Bill for creating a Board of Gas Commissioners, "with greater powers of inspection and control over these Companies than any other State Commission in any State has ever been given over any kind of corporation." Regardless, however, of any new or previously existing laws, and of the terms under which they were granted the right of supplying gas to Boston, the Bay State Company pursued the tortuous tenour of their way; the concern being entirely controlled by Mr. Addicks. Mr. Gray describes, at much length, some of the most involved financial manœuvring we have ever tried to comprehend. Our feeling after reading the details is similar to that experienced on witnessing an expert conjurer's display. It is wonderful; but it is impossible to follow all the moves. The proceedings may, however, be summarized somewhat as follows.

So far as practical operations were concerned, the Company altogether—by their assignees, the Beacon Construction Company, owned by them—only constructed plant to the value of about $750,000, and acquired patents equal to another $250,000; making their total addition to the value of Boston gas undertakings, say, $1,000,000. They were chiefly concerned with financial evolutions, in the course of which they formed the Boston Gas Syndicate, which bought up stocks of some of the Boston Gas Companies of the nominal value of $3,987,000, for $8,571,645. These were again transferred to the Boston United Gas Trust (floated by yet another Company), with a capital of $10,000,000; and this Trust was absorbed by the Bay State Company of Delaware, whose capital was $17,000,000. (These operations involved also the formation of various other Companies, which we need not name.) In short, "the promoters of the Bay State Gas Company of Massachusetts formed this multitude of corporations, limited partnerships, trusts, syndicates, and contracts with themselves, in five States—to the Legislatures (and in some cases to the city councils) of which they had to make numerous and expensive appeals—all in the attempt to make the property which before paid 10 per cent. on less than $3,000,000 of capital, by the addition of about $1,000,000 to the investment (including patent rights), pay interest and dividends on $17,000,000 of capital." The history of the attempts to pay dividends on the inflated capitalization forms another chapter in that of the gas supply of Boston.

(To be continued.)

The new oil-pipe line from Baku to Batoum, 560 miles long, has been completed for a distance of 145 miles. The 8-inch wrought-iron pipe is to run parallel to the Trans-Caucasian Railway. The first section has three pumping-stations, each being equipped with two compound high-duty engines, with 21-inch and 42-inch steam cylinders and 24-inch stroke. These pumps work against a pressure of 650 lbs. per square inch, with a steam pressure of 150 lbs.; and the duty of each pump is fixed at 416,275,200 gallons per annum.

M. Henri Le Chatelier has been communicating to the Paris Academy of Sciences the results of some experiments on the development and propagation of the explosive wave. They show the application of the photographic method to the study of the subject. He has given measurements for various mixtures of acetylene and oxygen, acetylene and nitric oxide, acetylene and nitrous oxide, and carbon monoxide and oxygen. In the last case the velocities depend upon the mode of ignition, and upon the quantity of the fulminating substance used to start the explosive wave.

The formal opening of the new physical laboratory at Owen College, Manchester, took place on the 29th ult. The new building contains about forty rooms. The site measures 100 feet by 60 feet, and of the total cost of £33,000 the subscriptions fall short at present by from £9000 to £10,000. The Principal (Mr. Alfred Hopkinson) stated that the erection of the laboratory was due to munificent donations from two anonymous subscribers—one of £10,000 and the other of £5000. He was of opinion that for some time to come this would be the largest physical laboratory in the world.

PERSONAL.

The managership of the Athy (Co. Kildare) Gas Company has been obtained by Mr. G. W. YOUNG, of Carlow.

There appears to have been some misunderstanding in connection with the proposal to confer upon Sir J. J. HARWOOD the freedom of the city of Manchester, of which suggested distinction we have previously made mention. In a letter to the Lord Mayor, Sir John has declined the honour, and withdrawn his name. Political feeling seems at the bottom of the matter.

The members of the office staff of the Derby Gas Company were entertained to tea at the New Bath Hotel, Matlock, on Saturday, the 30th ult., by Mr. RICHARD FISHER, who has relinquished the position of Secretary of the Company. The occasion was chosen to present Mr. Fisher with a life-size platinotype portrait of himself, surrounded by portraits of each member of his staff. To the picture was attached a silver plate bearing the following inscription: "Presented to Mr. Richard Fisher by the office staff, on his retirement from the Derby Gas Company after fifty years' service, June, 1900." Mr. Kirk, the oldest member, in making the presentation, spoke feelingly of the good relationship which had existed for so long between Mr. Fisher and the staff, and of the sorrow with which he personally and all present contemplated the severance of the connection. He trusted Mr. Fisher would be spared for many years to enjoy health and happiness. Mr. Bullivant, the newly-appointed Secretary, said he should not like the opportunity to pass without expressing his gratitude to Mr. Fisher for the many kindnesses he had shown to him during the 27 years he had worked with him. Mr. Fisher, in accepting the portraits, thanked the staff for their kindness, and acknowledged his indebtedness to them for the loyalty with which they had served him during his official connection with them. A vote of thanks was accorded to Mr. Fisher for his hospitality, which was suitably responded to.

OBITUARY.

We have to-day to record the rather sudden death, on Monday evening last week, as the result of a ruptured blood-vessel, of Mr. H. S. EDMOND, who for about twenty years had been Manager of the Kenilworth Gas Company. Deceased was only in his 47th year. He leaves a widow and a large family.

We regret to announce that Mr. JOHN CHALMERS, Manager of the Greenock Corporation Gas-Works, died there on Thursday last, after a short attack of rheumatic fever. It may be remembered that he was only appointed Manager on the 20th of March last, on the retirement of Mr. Samuel Stewart. He had, however, been employed in connection with the Greenock gas undertaking since 1866. After twelve years' service, he was made collector, and held that office till he was promoted to the post of Manager. It was stated at the time that his appointment, which was a somewhat strange one for so important a works, was temporary. It has proved to be so, but unfortunately in a different way from that which might have been contemplated.

NOTES.

Exothermancy and Endothermancy.

Dr. Geoffrey Martin, of Bristol, writes to the "Chemical News" to discuss the classification of chemical combinations into the two great orders, endothermic and exothermic. In endothermic compounds, the atoms are held together in such a way that energy is stored up in the molecule. Consequently, when the molecule is decomposed, this stored-up energy is liberated, principally in the form of heat. Endothermic compounds are usually explosive, and for the reason that, in separating the atoms of the molecule, work is done with, not against, the internal atomic forces. In exothermic compounds, however, the contrary is the case; and the coming together of the atoms which compose them is attended with the evolution of energy. In order to decompose such a molecule, work must be done against the atomic forces within the molecule. Such compounds are therefore usually stable. The heat of formation of a compound may be either positive or negative, according as it is exothermic or endothermic. Now it is well known that the heat of formation of a compound is not a constant, but varies with the temperature. In a great many cases it diminishes with the increasing temperature. The dependence of the heat of formation upon the temperature has been investigated in the case of a very few endothermic compounds. Victor Meyer, in 1893, studied the case of hydrogen iodide. He found that this is an example of an endothermic compound gradually changing into an exothermic compound. Is the principle reversible, so that by heating an exothermic compound beyond the temperature at which its heat of formation is zero, it would become an endothermic compound? If so, here is the key to some very remarkable phenomenon of work at high temperatures. Dr. Martin meanwhile fails to see the necessity for drawing an arbitrary distinction between endothermic and exothermic compounds. He regards them as only the different stages of the physical alteration of a compound with the temperature. The fact that a compound is at ordinary temperatures endothermic or exothermic, as the case may be, is, according to his way of looking at the matter, a mere accident of the temperature.

An Automatic Fire-Alarm.

A description is given in the "Ironmonger" of May's automatic fire alarm, which is also calculated to be useful in giving warning of any dangerous rise of temperature in coal stores and other enclosed places. It depends upon the principle that if a fine copper wire is stretched along a wall near the ceiling, the amount of its sag at the middle will depend upon, and be proportional to, the temperature of the room, which is highest at the top. If in the middle of this span wire a short piece of wire is fixed, pointing downwards, it is obviously easy to so adjust this attachment as to make it touch an electrical contact piece and ring a bell, when it is caused to drop by the dangerous heating of the room acting on the sag of the span wire. This is the scheme of the apparatus; but, of course, it needs a little careful working out in detail, which the inventor has done. Clearly, some safeguard is needed to prevent the alarm being given (say) in exceptionally hot weather or when the temperature near the ceiling of a room is raised by ordinary heating and lighting. This is provided in an arrangement called the compensator, which consists of a light brass frame to carry the span wire and itself suspended upon studs in the wall. In case of any gradual rise of temperature to any moderate range, the brass frame would expand at about the same rate as the thin wire, so that there would be no increased sag, and consequently no contact. In case of fire, however, or abnormal rise of temperature, the thin wire responds more quickly to the influence than its supporting frame, and duly gives the alarm. The arrangement is reported to have proved of practical use in New Zealand, where it originated.

The Cost of Power in Bulk.

Some useful information relative to the question of the cost of electric power production has been published in "Engineering" by Mr. Philip Dawson, who has wisely depended on recorded facts, and eschewed estimates. Generally speaking, his data support the views of Mr. Parshall on this subject. He offers as reliable the conclusion that there is every reason to anticipate that power can be produced in very large well-designed stations, all charges included, such as interest on capital and sinking fund, for little over half a farthing per Board of Trade unit at the switchboard. The largest items in the cost of generating power are fuel and labour. On average American results, the fuel costs from 50 to 70 per cent. of the whole; wages coming next with from 13 to 26 per cent. The cost of the plant proper is, on the average, from one-half to three-fourths of the total cost of the complete installation, including land, buildings, and mains. Consequently, any little additional capital expenditure calculated to permanently reduce the cost of producing the power is well worth favourable consideration, especially when the plant runs practically continuously, as in the case of traction and power transmission. Continuous employment for the plant is the one essential condition for securing the greatest economy in production; but it does not yet appear what size of plant best realizes the ideals of the mechanical engineer. Mr. Dawson is emphatic, however, upon the point that a station which runs for lighting purposes only will not generate power cheaply, and *vice versâ*. To design an economical station for traction or power transmission, is special work requiring a great deal of knowledge and experience which practice in the lighting branch of electrical engineering cannot supply.

The Latest Blast-Furnace Gas-Engine.

The performance of a blowing engine at Seraing, driven by blast-furnace gas, has been recorded in this column. It is reported in "Engineering" that one of the really important novelties in the Paris Exhibition is a still later and more improved gas-motor of the same character, the joint invention of M. Delamare-Deboutteville and the John Cockerill Company. Of course, this engine cannot be shown working with blast-furnace gas; but it was very thoroughly tested with this fuel before leaving the works of the Cockerill Company. It is the first of the special type that has been constructed; and the blowing mechanism also shows special details. The engine is rated at 600-horse power, and has a single cylinder over 51 inches diameter. It occupies a space 36 feet long by 19 ft. 8 in. wide; and the flywheel weighs 33 tons. At the works, the engine took the gas from five blast-furnaces making Bessemer pig, which was collected in a chamber, where it was thoroughly cooled and washed with water. The best result that was obtained during the trial was 900 indicated horse power, giving effective work of 725-horse power in compressed air, for a gas consumption of 100·8 cubic feet per hour. M. Hubert, Director of Mines in Belgium, prepared the report on these trials, and remarks on the progress made in the direct utilization of blast-furnace gases for generating power since the first tentative experiments at Seraing in 1895. It was then considered necessary to provide extensive apparatus for cleansing and scrubbing the gas; and M. Hubert pays a high compliment to the ability and perseverance with which M. Delamare-Deboutteville and the engineers of the Cockerill Company have met and overcome all the difficulties that attended a complete solution of the problem.

THE FUTURE OF WATER GAS IN FRANCE.*

The system of blowing up, with the production of carbon monoxide, in the manufacture of water gas, always means recuperation of the heat of combustion of this oxide—heat which will be utilized in accordance with requirements, but which unfortunately complicates the apparatus. Side by side with this system for producing water gas, there is another which is more important for French gas managers, who cannot think of carburetting water gas by means of the extremely dear petroleums which are alone available; and that is the system of producing carbonic acid by blowing. This system is based upon technical considerations of which the writer will give some indication. It is well known that the production of a molecule of water gas—

$$CO + H_2 = 44{\cdot}64 \text{ cubic metres.}$$
$$12 + 16 + 2 = 30$$

requires a certain expenditure of heat—

				Cal.
H_2 to produce H_2O in vapour	= 2 ×	28,780	=	57,560
C „ CO „	= 12 ×	2,400	=	28,800
				28,760

The operation of blowing, therefore, should produce 28,760 calories in order to make 30 kilos. of water gas. Now, 1 kilo. of carbon transformed into carbon dioxide at the expense of air requires $2\frac{2}{3}$ kilos. of oxygen, to which correspond 8·834 kilos. of nitrogen contained in the necessary volume of air. Under constant pressure, the specific heats are: For CO_2, 0·2164; for N, 0·2440. The following is a table of specific heats under constant pressure:—

	Air = 1.		Aqueous Vapour = 1.
Air	1·0000	..	0·2377
Vapour of ether	2·0235	..	0·4810
Alcohol	1·8986	..	0·4513
CO_2	0·9104	..	0·2164
CO	1·0793	..	0·2479
O	0·9180	..	0·2182
CH_4	—	..	0·3280
C_2H_4	—	..	0·4210
N	1·0265	..	0·2440
H	14·3231	..	3·4046

If the blowing-up gases contained only carbonic acid, and escaped at t', each kilogramme of carbon would carry away, for its transformation into carbonic acid—

$$K' = t\,[(2\tfrac{2}{3} + 1) \times 0{\cdot}2164 + 8{\cdot}834 \times 0{\cdot}2440] \text{ calories}$$
$$\text{or } t \times 2{\cdot}9669 \text{ calories.}$$

Now, a kilogramme of carbon transformed into carbon dioxide produces 8080 calories; so that, in reality, there will remain in the coke only $8080 - 2{\cdot}9669\,t$. If we calculate also what goes on when this quantity of carbon monoxide is produced instead of carbon dioxide by blowing up, we see that to produce the 30 kilos. of water gas we require 1 kilo. of carbon transformed into carbon monoxide, and 1·33 kilos. of oxygen, corresponding to 4·417 kilos. of nitrogen. The specific heats, as shown by the table given above, are: CO, 0·2479; N, 0·2440. We arrive, therefore, at eliminating under this form—

$$K'' = (2\tfrac{1}{3} \times 0{\cdot}2479 + 4{\cdot}417 \times 0{\cdot}2440)\,t$$
$$K'' = 1{\cdot}6553\,t \text{ calories,}$$

the heat required for producing hydrogenated gas. And inasmuch as the transformation of carbon into carbon monoxide gives 2400 calories, there remain in the coke $2400 - 1{\cdot}6553\,t$ calories. But t is different in the two cases, according to whether by blowing up we produce carbon dioxide or carbon monoxide. If in the latter case we make $2440 - 1{\cdot}6553\,t = 0$—that is to say, that there is no available heat for the production of hydrogenated gas—then $t = 1450°$ C., or about the melting-point of nickel.

In order that, in the first case, there should be no heat available for the production of hydrogenated gas, it would be necessary to have a temperature (if $8080 - 2{\cdot}9669 = 0$) of t 2740° C. —one never realized in practice. In one volume of air we have 21 per cent. of oxygen and 79 per cent. of nitrogen. One volume of oxygen combining with a like quantity of carbon produces two volumes of carbon monoxide; and the same bulk of oxygen combining with one volume of carbon monoxide produces a volume of carbon dioxide. If in 100 volumes of blowing-up gas there is a certain quantity of oxygen which we will call x combined with CO and CO_2, we shall have a volume—

(1) V of CO_2.
(2) $2\,(x-v)$ of CO.
(3) $\frac{79}{21}\,x$ of N.

Whence—

$$V + 2\,(x-v) + \frac{79}{21}\,x = 100 \text{ vols. of blowing-up gas.}$$

From this we obtain the value of x—

$$21\,V + 42\,(x-v) + 79\,x = 2100.$$
$$21\,V + 42\,x - 42\,V + 79\,x = 2100.$$
$$121\,x = 2100 + 21\,V$$
$$(1)\quad x = \frac{2100 + 21\,V}{121}$$

* The previous article on this subject appeared in the "JOURNAL" for April 17 last (p. 997).

If the volume of carbon dioxide is the same as that of carbon monoxide—in other words, if $V = 2\,(x-v)$, we have—

$$3\,V = 2\,x, \text{ and } x = \frac{3\,V}{2}$$

Transposing, we get in equation (1)—

$$\frac{3\,V}{2} = \frac{2100 + 21\,v}{121} \text{ or}$$
$$363\,V - 21\,V = 4200 + 42\,V, \text{ and}$$
$$V = \frac{4200}{321} = 13{\cdot}08 \text{ per cent.,}$$

the volume of air required for blowing up.

In the preceding processes, 13·08 per cent. of carbon dioxide is never reached; and in the Lowe process 9·7 per cent. is never exceeded.

Representing the carbon passed to the generator by y, the quantity of carbon transformed into carbon dioxide by blowing, $1-Y$ will be that which is transformed into carbon monoxide. But we have—

$$(2)\quad \frac{Y}{1-Y} = \frac{V}{2\,(x-v)}$$

as 1 cubic metre of carbon dioxide contains as much carbon as a like quantity of carbonic oxide.

From (2) we obtain—

$$2y\,(x-v) = v\,(1-y)$$
$$2y\,(x-v) = v - vy$$
$$v = 2y\,(x-v) + vy$$
$$v = y\,[2\,(x-v) + v]$$

and
$$y = \frac{V}{2\,(x-v) + v}$$

But we can replace the volume of carbonic oxide—$2\,(x-v)$—by V_1; and then we have—

$$y = \frac{V}{V_1 + V} \quad \left(\text{or } y = \frac{1}{\frac{V_1}{V} + 1}\right)$$

If S represents the heat available to produce the hydrogenated gas, we have—

$$\underset{\text{Heat liberated by the transformation into } CO_2.}{K' \times y} + \underset{\text{Heat liberated by the transformation into CO.}}{(1-y)\,K''} = \underset{\text{Available heat.}}{S}$$

Replacing y by its value $\frac{V}{V_1 + V}$, we have—

$$K'\,\frac{V}{V_1 + V} + \left(1 - \frac{V}{V_1 + V}\right) K'' = S$$

Whence—

$$\frac{K'\,V}{V_1 + V} + K'' - \frac{K''\,V}{V_1 + V} = S \text{ and}$$
$$K'' - \frac{V}{V_1 + V}\,(K' - K'') = S$$

We have seen that, in order to get a molecule of water gas, it is necessary to produce 28,760 calories in blowing up, by the combustion of the carbon. On the other hand, a molecule of water gas, as already shown, contains 12 C. In order, therefore, to produce 44·64 cubic metres of water gas, the quantity of carbon to be expended will be—

$$12 + \frac{28{,}760}{S}$$

Then 1 kilo of carbon will produce a certain number N of cubic metres, equal to—

$$N\ \frac{44{\cdot}64}{12 + \frac{28{,}760}{S}}$$

Replacing S by its value in the function of K' and K'', we get an expression for N into which only V, V_1, and t enter. We have besides $V_1 = 2\,(x-v)$ or—

$$V_1 = 34{\cdot}71 - 0{\cdot}653\,v$$

Starting with V = 13 in 100 cubic metres of blowing-up gas, varying by one unit its value up to 21, seeking the corresponding values of V_1, and drawing up the table of variations corresponding to those of t comprised between 600° and 1000°, we obtain the following results:—

Percentage in the Blowing-up Gases of		Yield of Water Gas, in Cubic Metres, per Kilogramme of Coke (C).				
CO_2.	CO.	600°.	700°.	800°.	900°.	1000°.
13	13·22	2·27	2·22	2·16	2·10	2·03
14	11·57	2·33	2·28	2·23	2·16	2·10
15	9·91	2·39	2·34	2·29	2·23	2·17
16	8·26	2·44	2·39	2·35	2·29	2·23
17	6·61	2·48	2·44	2·40	2·35	2·29
18	4·95	2·54	2·50	2·46	2·41	2·36
19	3 30	2·59	2·55	2·51	2·46	2·42
20	1·65	2 64	2·60	2·56	2·52	2·47
21	0·00	2·69	2·65	2·62	2·58	2·53

In practice, we can exceed 18 per cent. of carbon dioxide (theoretically, according to Jaeger, 21·3 per cent.); and consequently we can easily obtain 2·50 cubic metres of water gas for 1 kilo. of carbon. In the systems in which blowing-up produces carbonic oxide, this yield cannot be reached. In the Lowe process, the quantity of carbonic acid does not exceed 9·7 per

cent. Starting from there, we can easily calculate the possible yield of water gas. If instead of 9·7 per cent. we assume 10 per cent., we get 1·03 cubic metres as the yield at 600°.

From the preceding considerations we are able to draw the following general conclusions: The blowing-up process, with the production of carbon monoxide, which may be called the Anglo-American, and its combustion in fixing chambers, yields a smaller quantity of water gas than that with direct production of carbon dioxide, which may be designated the German process. However, it is difficult to decide absolutely as to the special merits of each of these processes, as upon the question of yield depends a second, and very important, one, though it is of a purely economic order—viz., the selection of the raw material for carburetting the water gas. Consequently, so far as we are compelled by the taxes put upon petroleum to exclude this product or admit it for the purpose of carburation, so shall we be forming two opposite camps, in one of which will be found the countries where petroleum is not burdened with duty, such as America, Great Britain, and Belgium, and in the other those in which this illuminating agent is subject to heavy Customs imports, such as Germany, France, &c. In the former group, the Anglo-American process can be employed with advantage; the diminution in the yield being compensated for by the complete gasification of the petroleums utilized for carburation. In the latter, the German process only, in which another carburetter—benzol—can develop with some chances of success. In the first process, the phenomenon of carburation is a chemical one—a veritable dissociation of the petroleum at high temperatures. In the second, carburation by benzol is a phenomenon of a physical character—simple vaporization—and as such is more delicate and less perfect than the other.

However, the utilization of water gas as a calorific agent only brings these two situations to about the same level; as with the Auer burner there is no need either of the light-giving hydrocarbons of the paraffin series or of benzol vapour. The simple mixture of carbonic oxide and hydrogen constitutes a gas eminently suited for the production of superb incandescence, which is all the more beautiful because it requires only a small quantity of secondary air. It is, in fact, this difference in the consumption of air which enables us to say that the Auer burner, consuming pure water gas (blue gas) is more hygienic than any other system of gas lighting. This is shown by the following table*:—

Kind of Light.	Results for 1000 Candle-Hours.			
	Heat Emitted.	Carbonic Acid.	Aqueous Vapour.	Oxygen Employed.
	Calories.	Cub. Met.	Cub. Met.	Cub. Met.
Acetylene	7,200	1·200	0·600	1·500
Electric arc	2,490	..	..	..
Coal gas	40,000	4·240	11·000	9·760
Coal gas and Auer burner .	10,500	1·113	2·900	2·560
Water gas ,, ,, .	3,600	0·640	0·725	0·665

* "Journal für Gasbeleuchtung" for 1899, p. 94.

The objection raised to water gas that it is odourless exists no longer when there has been imparted to the gas the very unpleasant smell which characterizes the thioaldehydes; and therefore, freed from the reproaches which have been heaped upon it, the water-gas industry is assuming formidable proportions outside France. A single English firm—that of Messrs. Humphreys and Glasgow—have witnessed their installations increase from 80 million cubic feet per day in 1892 to 230 millions up to the middle of last year. This shows in a very striking way the interest taken in this very important question. It is in the power of Frenchmen also to give a similar impetus to the industry. The road has already been marked out for them; all they have to do is to follow it.

J. A.

"Field's Analysis" for 1899.—The analysis of the accounts of the principal gas undertakings in England, Scotland, and Ireland for the past year, prepared by Mr. John W. Field, Secretary and General Manager of the Gaslight and Coke Company, has been issued in the usual form. This is the 31st year of publication; and the value of the work is so generally acknowledged that no words of commendation are needed for it. It presents a mass of statistical information which may be utilized with advantage in the engineer's office, the Law Courts, or the Parliamentary Committee-rooms.

Report on Factories and Workshops.—The annual report of the Chief Inspector of Factories and Workshops for the year 1899 has just been issued. It shows that accidents reported under the Factory Acts were more numerous in 1899 than in any previous year; but the rate of increase was much less than in 1898. The total number of accidents reported in 1898 was 57,562, and in 1899 70,760; being an increase of 13,198, or 22·9 per cent. So far as accidents reported to the certifying surgeons are concerned, the increase was again relatively greatest among adults and males. While the minor accidents reportable only to the inspectors increased 25·2 per cent., from 38,335 to 47,989, the number reported also to the certifying surgeon advanced 18·4 per cent., from 19,227 to 22,771, and the fatal accidents 19·8 per cent., from 727 to 871.

TECHNICAL RECORD

WESTERN (U.S.A.) GAS ASSOCIATION.

(*Concluded from p.* 22.)

Mr. Donald M'Donald, of Louisville (Ky.), read a paper entitled "The Systematic Location of Gas and Other Mains in the Streets, as Opposed to the Popular Idea of a Subway." He said that but few of those who had advocated a subway as a means of avoiding the disturbing of the surface of the roads, had appreciated the enormous difficulties in the way of constructing such channels, and of arranging all the pipes and wires in them when completed. The question of levels would necessitate going to a most inconvenient depth in some localities; and even with the best construction and ventilation, there would be the risk of one service interfering with another—such as water leaking into the telephone cables, of escapes and explosions of gas, &c. Two-thirds of the digging in the streets was for the purposes of servicing; and if it was necessary to have extra deep excavation, the trouble from disturbing the roads would be greater than before. It would be unwise, as a general rule, to combine the subway with the sewer system; but apart from its use as a sewer, there would be the necessity for being able to inspect and repair each system independently of the others; and some of the trunk mains would be 5 feet or so in diameter. A tunnel 10 feet wide and 10 feet high would be the very smallest section possible; and the cost of this would be over £5 per lineal foot, not including anything for laying the mains. Then the roof of the tunnel would be riddled with outlets for service-pipes. He proceeded to outline a plan that would accomplish all the good results of a subway, and avoid most of the objections. The pipes in streets running north and south should be laid about 2 feet deep, and those in streets running east and west about 4 feet deep; the actual depths, of course, varying with the climate and depth of the frost line. Each pipe should have a given locality from the curb line—for instance, gas 2 feet, water 3 feet, natural gas 4 feet, telephone 5 feet, and so on. Where connections were necessary, all pipes should join each other by openings at the top and bottom, instead of side openings as at present; and service-pipes should be attached at the top with a swinging elbow. All lines of pipes could thus be kept at the same level, instead of having to dodge each other as at present; and the extra disturbance and excavation due to deeply laid pipes would be avoided. At present there was a great deal of useless digging in searching for the required main, mistakes in tapping the wrong one, &c., which would be entirely obviated by his system. Several lines of main could be laid at one operation, by arrangement between the various companies concerned; and the low level would be entirely unimpeded and available for sewerage works. Each line could be got at for repair without interference or risk to the others; and there would be no undermining. As to services, the companies should be required to provide, at each house, or at convenient intervals, a service-channel 18 inches wide and 2 or 4 feet deep, covered with strong iron plates; and the various service-pipes would lay in the bottom of these channels. Long services, and those to the other side of the street, could be laid in terra-cotta tubes. The whole system could be controlled and inspected for leakage whenever required. This system could be enforced in all its entirety in new streets, and gradually introduced into old ones as circumstances permitted, by requiring that all new conduits should be laid in their legal position, and that all obstructions should be removed by the owners. The form of service-channel he had described would only be necessary in busy localities, and could be modified and cheapened in the country or suburbs. By means of this system, an ordinary street would accommodate eighteen rows of mains, each averaging 1 foot in diameter; and it might, by a little management at the crossings, be practicable to adopt an even depth—say, 3 feet—all over the city.

The President said that the author had certainly submitted a novelty for the consideration of the Association. Mr. Mayers thought that the service-channels would be objectionable. The public would not stand rows of iron plates at every 100 feet or so; and the services would not be protected against frost. Combined action in the way of running services in the same trench would call for a greater sympathy between the different companies than at present existed; and he questioned whether it would be a good plan to run gas and water pipes in the same trench. Combined action on the part of all the companies concerned, on the lines indicated in the remainder of the paper, would be a move in the right direction. He proceeded to read a letter from Mr. Julian Griggs, City Engineer of Columbus, who stated that it would be impracticable to combine subways with the sewerage system; and apart from this, on account of cost they would only be possible in wealthy populous neighbourhoods, where the importance and magnitude of the service rendered would be equal to meeting the cost. The annual rental charged in Chicago for a 3½-inch telephone conduit was £160 per mile, and in New York £200 per mile; so that a subway 10 feet by 10 feet, and costing £5 10s. per foot run, need not be prohibitive on account of cost. But if subways were provided, it was possible that many companies would prefer not to use them, or find them unsuitable. The suggestion to keep the mains in one plane was valuable; but the use of service-channels covered with iron plates would be neither satisfactory nor economical. The providing a definite location in the street for each

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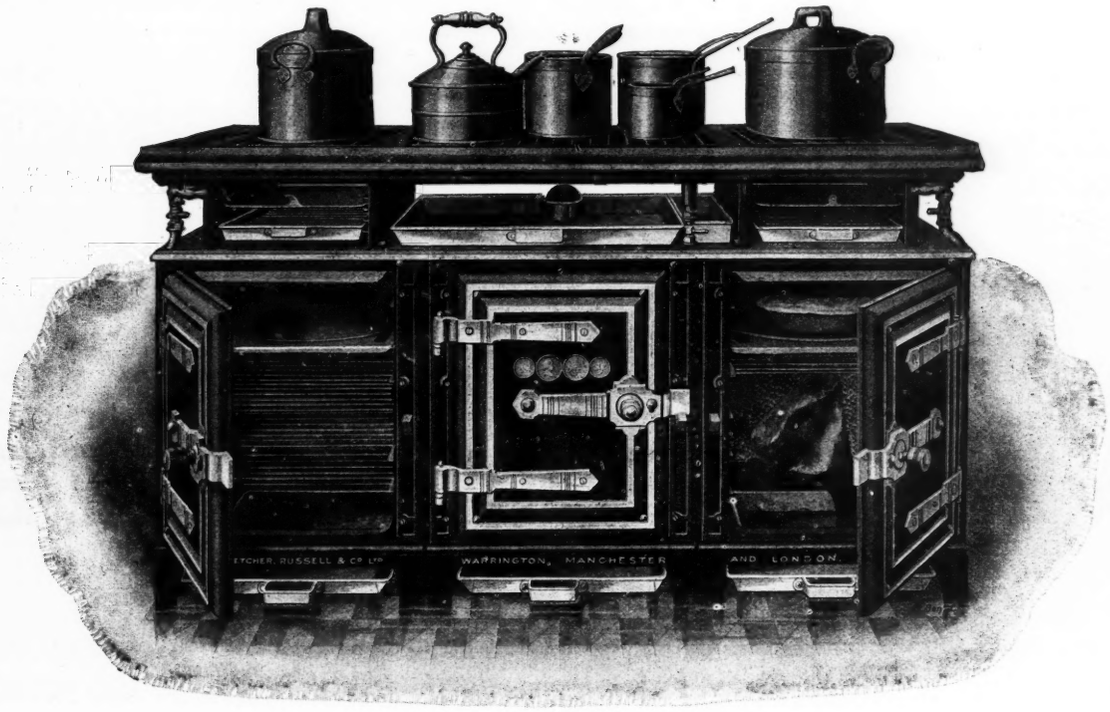

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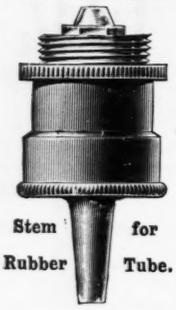

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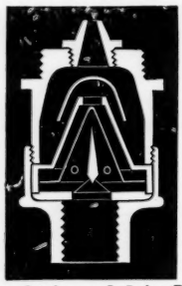

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TRADE MARK.

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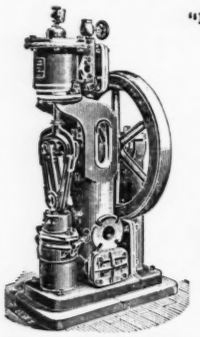

Fig. 705. "SINGLE RAM" STEAM-PUMP.

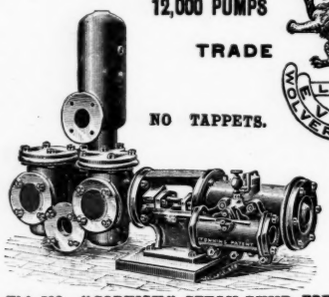

Fig. 898. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

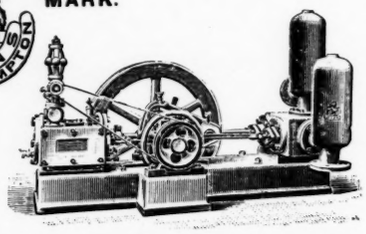

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

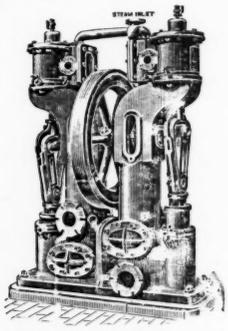

Fig. 719. "DOUBLE-RAM" STEAM-PUMP.

A NEEDFUL NOTICE

TO ALL WHOM IT MAY CONCERN.

We hereby intimate to Chairmen and Members of Gas Committees, Engineers and Managers of Gas-Works, that we have PURCHASED THE BUSINESS AND PATENTS OF THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, Westminster, London, and are now the Sole Owners of the Patents of the pre-eminently successful system of Self-Acting Conveyors and Elevators in combination with the Storage Hoppers, the Measuring Chambers, and the Charging-Shoots, forming together the much admired and happily-designated "powder-pouch" method of charging Inclined Retorts, now in operation, or in course of erection, at—

Aberdeen,	Cambridge,	Leeds,	Nine Elms,
Batley,	Chesterfield,	Leigh,	Rotherham
Bow Common,	Coventry,	Manchester,	Smethwick,
Brentford,	Dewsbury,	Middlesbrough,	Todmorden,
Brighouse,	Dudley,	Middleton,	Wakefield,
Burnley,	Gateshead,	Nelson,	West Hartlepool,
Burslem,	Huddersfield,	Newcastle,	Wolverhampton.

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line of pipe was a much needed reform. Special connections would be required at the crossings, of a rather more complicated character than those at present used, which would lead to slightly increased trouble from leakage, &c., at those spots. He suggested combined action with the American Society of Municipal Improvements, and the appointment of a Committee comprising representatives of the whole of the interests concerned. Mr. Addicks said that in new roads at Boston the rule was to lay gas-mains at a uniform distance of 6 feet from the curb, and at least 3 feet deep, and the water-main on the opposite side of the streets. He approved of the suggestion to tap the mains at top or bottom only, and not at the sides; but he thought that services for different purposes should be at least 1 foot apart. It was no uncommon thing for escaping currents of electricity to cause fires by melting the gas-pipes. With regard to the presence of gas in electrical conduits, which was invariably blamed to the gas company, he mentioned an instance where a conduit was found to be full of oil gas, manufactured by electricity from the oil used for insulating in the transformer chamber. Mr. Witherby said he would not care to have to lay a line of main between two other existing lines only about 3 feet apart. Mr. Steinwedell preferred to take measurements from the property line, and not from the curb, which was liable to be changed. Mr. Norris said that the plan mentioned in the paper assumed one constant width of street. It would be better that the pipes should be located in proportion to the width of the street; and in one place this had been done. Something of this sort would be necessary where narrow and wide streets had to be dealt with.

Mr. M'Donald, in replying to the discussion, said that with his system it would be possible to inspect and keep the services sound and in good order. Most of the objections urged against the service conduit applied to the condition of services as at present laid. He could not follow the suggestion that his system would lead to increased leakage at crossings. As to possible danger from electrolysis, he looked forward for the time when gas men would refuse to sit idly by and see their structures destroyed in this way. Why one concern should suffer enormous loss, just because another did not choose to put one more wire into its distribution system, was really more than he could understand.

Mr. T. D. Miller, of Dallas, read a paper on "The Hygienic Use of Coal Gas." He referred to Professor Tyndall's experiments proving the presence of germs in the atmosphere, that would propagate when deposited upon suitable material; and to the fact that large numbers of diseases were ascribed to bacterial origin. The atmosphere of an ordinary living-room would be comfortable, in cool bracing weather, even with several occupants and no special means of ventilation; but in warm dry weather it would be insufferable in a few minutes, unless a fan or ventilator was adopted to keep the air in motion. For hygienic reasons, a moist atmosphere was preferable to a dry one; and it was also a fact that heating apparatus would accomplish its work better, and more economically, if it furnished a moist heat or atmosphere. He quoted from an article by Professor Arche, of Vienna, in "Der Gastechniker," on "Moisture in Gas-Heated Rooms," to show that the moisture should not fall below 40 or rise above 75 per cent. of complete saturation, or discomfort and even worse might follow. A room with damp air needed to be warmed, and one with dry air might require to be cooled. The Professor used in his experiments an instrument known as Lambert's Polymeter, which would indicate, in addition to the temperature, the percentage of moisture, the saturation pressure of the water vapour, the maximum quantity of moisture the air would carry, and the difference between the actual temperature and the dew-point. Observations were conducted in a living-room, and in a school-room unwarmed, and also heated by a close stove. The latter made the air too dry; and therefore the effect of using gas-stoves for warming was tried. They were found to have a beneficial effect as far as the moisture in the air was concerned. He next quoted a paragraph from "The Chemistry of Illuminating Gas," by Mr. Norton H. Humphrys, to show that ordinary living-rooms required a degree of ventilation far in excess of that necessary for the combustion of gas, and that the fact of a gas-burner causing discomfort was of itself evidence of insufficient ventilation. Mr. Thomas Wills had remarked that the carbonic acid in the atmosphere should not exceed 6 parts in 10,000. This was not on account of the poisonous nature of carbonic acid, but because it was an indicator of the presence of organic matter exhaled from the lungs. The object of ventilation was to remove, not only carbonic acid and water, but also organic matter; and any process that destroyed the latter would be beneficial. A gas-flame was of great service in this respect, as shown by the dark deposit upon the ceiling above it. These sooty deposits were simply charred and destroyed organic germs; and it is possible that many millions of deadly disease germs are cremated in this way, for Professor Tyndall had proved that air was sterilized by contact with red-hot surfaces. Argand and incandescent burners in particular must, therefore, be valuable air-purifiers. In a room heated by a gas-stove, the odour of a volatile oil, sprinkled on paper and held in the ascending current of hot air, was diffused into every part of the room in less than a minute; but in a room heated by a coal-fire, the diffusion of the odour was much less rapid. Diffusion through ordinary walls was more rapid as the difference between the inside and the outside temperature increased; and therefore the use of gas increased diffusion in the upper parts of rooms, and thus assisted ventilation. Some persons objected to the employment of bath-heaters in which the water came in contact with the products of combustion from the gas. But he contended that, so far from being injured, the water was benefited from a sanitary point of view. Where warming was done by steam or close stoves, and lighting by electricity, contagion was certain to be more prevalent in the absence of some new microbe-extermination process.

Mr. Ferrier, being invited by the President to speak on the subject, quoted some figures to prove that, unless provision was made for the exit of the products of combustion, heating by gas was not likely to be a hygienic success. As to lighting, he asserted that the Welsbach burner was the most healthful of all methods. The progress of hygiene meant a great increase in the use of gas; and in the future they would see gas-burners in or near the ceiling drawing away the vitiated air, with suitable arrangements for throwing down either the heat or the light as required. Gas Associations would do well to get these things demonstrated by well-known scientists.

A paper describing a central station electrical plant operated by a gas-engine was submitted by Mr. J. C. Small, of Aurora (Ind.). It was in the summer of 1890 that he undertook to supply electricity; and as at that time gas-engines were considered to be too unsteady for successful working, an intermediate shaft 14 feet long and 4 inches in diameter, with a 2000 lb. balance-wheel in the centre, and the usual driving-pulley at one end and clutch pulley at the other, was a part of the plant. This arrangement secured steady working. He used Second Pool Pittsburg coal for gas making, and had an average yield of 4¼ cubic feet per pound. About 900 cubic feet of this gas consumed in his engine per hour, furnished electricity for sixty 6·8 ampère 45-volt arc lamps, over 12 miles of wire. After ten years' use, the engine was in excellent condition. He went on to urge that, as gas-engines could do more conveniently and economically anything that a steam-engine could do, gas companies should employ them to a greater extent on their own works. For a gas company to employ a steam-engine, was almost an admission that a gas-engine would not answer. He had fixed two engines—one of 40 and the other of 20 horse power—for running machine-shops, and a dynamo and electric light installation with each. They had been in operation two or three years, and gave thorough satisfaction. But in fixing arrangements of this sort, it was very necessary to send an experienced man to start the working, and show the consumer the proper way. This applied, not to engines alone, but to every form of gas apparatus.

The President said some letters had been received relating to the working of gas-engines, which the Secretary would read. The first was from Mr. J. M. Rusby, describing a gas-engine plant operated by producer gas. There were eight engines, 384-horse power in all, which furnished electric light for the station and yard, compressed Pintsch gas, and operated elevators, a small machine-shop, and air-compressors. They were all Otto engines; and the largest, which was 90-horse power, had two cylinders in tandem, and ran at 168 revolutions per minute. The producers were each 7 feet diameter inside and 15 feet high. Small anthracite was used as fuel; and the fuel bed was 6 feet deep, supplied with air by a steam-jet blower. Some of the engines were originally made to work with coal gas, and were adapted for producer gas by enlarging the inlet-ports and increasing the compression. The second letter was from Mr. A. M. Jones, the Superintendent of the Sistersville Electric Company, who had one 125 horse power, three-cylinder Westinghouse gas-engine operating a 90-kilowatt Westinghouse generator; also two double-cylinder 110-horse power Otto gas-engines, operating a similar generator of 120-kilowatt power. The regulation of speed was excellent, varying only 1 or 2 per cent. with changes from one-fourth to maximum load. The cost of operating was much less than with steam. They sold current at 3d. per unit; and during the month of April the plant earned £165, and the gas bill was £12 10s. This included the cost of pumping water for cooling from their own wells. Repairs had been very small; and the engines they had would be very suitable for operating a street-car plant, as they could throw on 400 lights without making over 2 per cent. fluctuation on the voltage. The gas used was natural gas; the cost being 6¾d. per 1000 cubic feet, and the power 966 units per cubic foot. Mr. W. Wallace, of Lafayette (Ind.), strongly supported the author of the paper, and described an electrical plant consisting of two alternating dynamos and a rotary transformer, operated by two 125-horse power gas-engines, supplied to natural gas, costing 3½d. per 1000 cubic feet. One engine supplied 300 to 1400 16-candle power lamps, and the other furnished an average of 25-horse power to motors. The engines had not proved at all successful. Within a year one or two cylinders, the main crank-shaft, and nearly the whole of the small gear, had to be replaced. Mr. Egner knew something of the last case, and believed the cause of the trouble was the use of very hard water for cooling, which deposited scale on the outside of the cylinders, and thus caused overheating. He was glad to see considerable progress in the use of gas-engines of late. Much trouble arose from not having the engines properly adapted to the kind of gas to be employed. There was a great difference between the properties of natural gas and producer gas. Engines were now built that would not consume more than 15 cubic feet of water gas per horse power.

Mr. Howard said it was too late in the day to speak of gas-engines not working successfully. Any trouble arose from want of common sense on the part of the "engineers" who operated them—such as using castor or other unsuitable oil. For intermittent power, there was nothing to equal the gas-engine. Mr. A. S. Miller said that the gas-engines which gave so much trouble were either defective in design or else not properly cared for. Steam-engines were, for similar reasons, frequently a failure; but that was no discredit to the principle. Mr. Steinwedell said the advantages of gas-engines were: Small water requirements, no need for being close to a railway or for rail connection, no smoke nuisance, small ground space, less cost for conducting mains, and ability to accurately gauge the consumption of gas and to adjust the power at a minute's notice. One lamp-hour of 55 watts required 3½ cubic feet of gas.

Mr. Doherty repeated the arguments in favour of a National Bureau for advertising that were urged at the recent meeting of the Ohio Association, and moved that the President name a delegate from this Association to confer with other Associations and to report at the next meeting. Mr. Diall seconded, and Mr. Roper eloquently supported the motion, and it was adopted.

A report from the Committee on Cyanides was read by Mr. E. E. Eysenbach. It included a description of the manufacture of cyanide of potassium, and stated that the average quotation in New York during 1899 was 1s. 2d. per pound; while that for yellow prussiate was 9½d. No doubt the recovery of cyanogen at present was very remunerative; but the demand was limited, gold extraction being almost the only application for it. If all gas companies at once took up the recovery of cyanogen, it would be a drug on the market.

Mr. F. H. Shelton, the Editor of the "Wrinkle" Department, next submitted his annual report. He described a neat device for showing the strength of liquor at the outlet of a scrubber or washer, comprising a perpendicular tube, in which the hydrometer floats, and a glass shade cover, through which the indications of the instrument can be read. Another ingenious device was intended to ease down the speed of the blower engine in connection with water-gas apparatus, at the conclusion of each "blow;" thus avoiding the strain and jerking due to a sudden stop. A regulator steam-cock, with scale and pointer, was also suggested for use on the steam supply to the generator. The employment of a weather board, supported by brackets attached to the curb of the tank, and having a rubber strip to make contact with the holder, was recommended for the annular exposed space of gasholder tanks, as tending to retard freezing and prevent snow from the top from lodging therein. For indicating the proportion of gas going each way, in the case of two purifiers or other apparatus worked in parallel, a light flap-valve was arranged, fitted in a cast-iron box on the line of pipe, and having a pointer and scale outside, so that the position of the valve could be seen. At the conclusion of the report, it was decided, on the suggestion of Mr. Shelton, to collect and print the "wrinkles" in pamphlet form.

After conducting some routine business, the Committee on "Final Resolutions" presented their report, which included votes of thanks to the President, the Secretary, and the Committee of Arrangements.

AMERICAN CIVIL ENGINEERS IN LONDON.

Last week the engineers of Westminster were very busy entertaining some 180 members of the American Society of Civil Engineers and Colonial Engineering Societies, as well as the ladies accompanying them. The visitors' principal object in crossing the Atlantic is to attend a conference in connection with the Paris Exhibition; and last week's events were the outcome of an invitation by the President (Sir Douglas Fox) and the Council of the Institution of Civil Engineers that they should visit London *en route*. Unwilling that the whole of their time should be given up to the delectation which their English colleagues freely provided, the Society determined to hold their annual convention at the same time under the roof of their hosts in Great George Street. Hosts and guests first gathered in the Library of the Institution on Monday afternoon; and there some of the distinguished heads of the engineering profession of this country extended a very cordial welcome to their American brethren. In such a throng of engineers, it would have been strange if the gas industry had been unrepresented; and it was not. Moving among the visitors, we noticed Mr. H. E. Jones, Mr. James W. Helps (the President of the Institution of Gas Engineers), and Mr. T. B. Younger, aforetime the Engineer of the Georgetown (British Guiana) Gas Company. Several interesting objects were on view for the inspection of the company; among them being the choice collection of valuable plate presented to Mr. James Forrest during the forty years he was Secretary of the Institution, and which bore silent, yet eloquent, testimony to the estimate of English engineers of Mr. Forrest's worth and work.

The welcome which Sir Douglas Fox addressed to the visitors was expressed in language which convinced the hearers of the pleasure it gave the Institution to receive their American friends, and of the great regard which English engineers possess for the brilliant engineering work which has been accomplished on the other side of the Atlantic. Having, in his remarks, referred to the cosmopolitan character of the Institution, a few words of sincere regret fell from Sir Douglas's lips that the health of their old Secretary, and now Hon. Secretary (Mr. Forrest), did not permit him to be present. A reference to the bonds which bind America and Great Britain led to the observation that, if the people of the United States, of Great Britain, and our Colonies would only stand together for what was right and true, the whole world could not prevent the progress that we all desire. It was, said the speaker, one of the great advantages that men of science and men of industry had, that they could sometimes approach the consideration of questions with a calmer mind, and with a more resolute determination to pull together, than was always possible in the political world. All through, and even in the past few years, there had been a most hearty feeling between the scientists and engineers on the Continent and those of this country; but that was only a distant feeling compared with what English engineers entertained for their brethren of America. Sir Douglas also alluded to the friendly competition which existed in the engineering industries of the two countries. A little historical information concerning the Institution concluded with the statement that it was now composed of a body of men scattered all over the British Empire and other parts of the world, numbering some 6000, and with students above 7000. Acknowledgment of the cordial welcome was made by Mr. John F. Wallace, the President of the American Society, Colonel Haines, and Mr. Jesse M. Smith.

Tea and friendly conversation occupied the time between the reception and the delivery of Mr. Wallace's Inaugural Address in the Lecture Theatre. To the technical business of the convention, Monday evening and the mornings of Tuesday and Thursday were devoted; but the only portion which directly concerned any of our readers was a discussion which took place on "The Filtration of Water for Public Use." The programme of pleasure arranged by the Institution included a visit to Windsor Castle on Tuesday afternoon, a reception by the President and Council at the Guildhall on Thursday evening, and an excursion to Warwick Castle and Stratford-on-Avon on Friday. At Windsor Castle, the large company were received very graciously. Tea was served, and Her Majesty visited her guests on the East Lawn. The entertainment of the visitors throughout the week was of a very liberal character; and in their recollections of their journeyings from home, the hospitality and cordial reception of their English colleagues will no doubt be one of the brightest.

THE RELATIONSHIP BETWEEN COST OF WATER WASTED AND COST OF DETECTION AND PREVENTION OF WASTE.

The second paper read at the meeting of the British Association of Water-Works Engineers at Cardiff was by Mr. A. J. Jenkins, Assoc.M.Inst.C.E., who was formerly Assistant Water Engineer in the town. The subject dealt with is stated in the title above; and the following is an abridgment of the communication.

In the opening paragraphs, Mr. Jenkins attributed the establishment of the now almost universal system of constant water supply in this country to the detection and prevention of waste. It can be proved, he said, that the cost of an efficient system of waste detection and prevention is amply repaid by the value of water saved. The main object of the paper was to show the value of the results obtained in Cardiff; and, when it is considered that the average pressure throughout the town is but 35 lbs. per square inch, it may safely be inferred that where pressures are higher, greater saving may be expected.

Before dealing with Cardiff, the author gave this brief review of what has been accomplished in some other towns: As early as 1859, the Norwich Water Company obtained an Act to enable them to prescribe in detail the nature of all fittings and pipes, and the work connected therewith, and to interdict the use of existing fittings and pipes which, in their judgment, might tend to waste, with the result that, within a few years, the consumption of water was reduced from 40 gallons per head per day (intermittent supply) to 15 gallons (constant service). In the following year (1860), the Manchester Corporation obtained similar powers, and quickly reduced the domestic consumption under constant supply from 35 gallons per head per day to 14 gallons. The system of inspection and supervision of fittings employed at Norwich and Manchester, however, proved abortive in Liverpool; and in 1874 Mr. Deacon introduced the waste-water meter system, with immediate beneficial results—the domestic consumption being reduced by about 6 gallons per head per day, and the intermittent supply (averaging 12¼ hours a day) converted into a constant supply. The "Deacon" water-meters have been very generally adopted with excellent results, notably in Southampton, where a consumption of over 60 gallons per head per day has been reduced to less than 30 gallons; Carlisle, from 40 gallons to 23½; Portsmouth, from 35 gallons to 18¼; Bradford, from 27 gallons to below 20; the Lambeth Water Company (London), 34 gallons intermittent service to 20 gallons constant; and the Southwark and Vauxhall Company, 38 gallons intermittent to 22¼ gallons constant.

Two cases where excellent results have been obtained without the use of waste-water meters may also be cited. In Leicester

the total consumpton of water for all purposes was reduced from 25·5 gallons per head per day in 1879 to 17·56 gallons in 1892. At Sheffield a consumption of 41 gallons per head per day was reduced in two years to 22 gallons; and it was stated by Mr. Eaton "that they did the work regularly year by year for a population of over 350,000 for £1005 per annum."

Coming to Cardiff, Mr. Jenkins said: The daily consumption for all purposes averages about 20 gallons per head per day in winter; and it has run up as high as 28 gallons in the hottest days of summer—25·5 gallons being regarded as the average hot weather consumption. Of this the quantity registered by meter, almost wholly for trade purposes, is between 7 and 8 gallons per head per day. It may be well to note that Cardiff is entirely a water-closet town, of which 15,400 are supplied directly through cisterns. There are also 10,200 baths directly connected; no additional charge being made for either. The system of inspection described costs £500 per annum for a population estimated at about 200,000; but this does not include any repairs, except the gratuitous renewal of tap washers.

The cost of water to the Corporation is about 7·5d. per 1000 gallons. But the works are capable of giving a larger supply if increased filtration area is provided; and it is probable that the cost will ultimately be reduced to 6d. per 1000 gallons. In comparing the cost of water saved with the cost of detection and preventien of waste, 6d. per 1000 gallons is adopted by the author as being a fair average.

The staff of waste inspectors employed within the borough numbers six; the whole being under the direction of the chief inspector. Two outside districts are looked after by their district inspectors, who act also as turncocks and meter inspectors in those districts, with occasional help from the town staff. The borough is divided into six districts; and each is periodically examined by means of a house-to-house inspection, when every fitting is examined, and every service sounded for hidden leakage. In nineteen years the number of inspections has been 14, 13, 17, 16, 15, and 16 respectively, which gives an average of one inspection of each district in 15 months. The number of houses within the borough is about 29,700. Six sub-districts have been provided with "Deacon" waste-water meters, of which one is a 6 inch meter controlling 1091 houses; the others are 4-inch meters—the number of houses on each being 874, 821, 481, 190, and 166 respectively. Some of these districts are larger than are usually to be found on 4-inch meters; but they can be subdivided if necessary, and the part cut off supplied from another direction. These meters are, with one exception, fixed directly upon the line of main, and when not in use the disc is allowed to drop to the bottom of the meter chamber.

In the meter-controlled districts, a test is made once in six months. If the waste-line shows a loss of less than 2 gallons per head per day in a district made up of cottage property, or 3 gallons per head per day in a district of villa property, the district is considered to be in a satisfactory condition. It is found, however, that one test in two (average) indicates a loss greater than the above, and a house-to-house inspection is proceeded with. But under no conditions is a district allowed to go for more than two years without such an inspection—the increased revenues resulting from the discovery of chargeable items being about £50 per annum.

It is a simple matter to arrive at the relationship between the cost of these inspections and the value of water saved in the meter-controlled districts; and as, with the exception of the measurement of the consumption, the inspection of the other districts is carried out on similar lines by the same workmen, a reliable estimate can be formed of the saving of water effected there by calculating it proportionately to the number of leakages discovered and repaired. Referring to the leaks discovered as the result of waste inspection, and calculating the probable amount of leakage on the figures ascertained from the meter-controlled districts, a daily waste is found of more than 544,000 gallons, or one-tenth of the total supply of the district, detected and remedied at an annual cost to the Corporation of £500. This quantity is sufficient for the supply of 20,000 people; and the value of it is £4964 per annum.

Since the year 1890, the Corporation have introduced the use of outside stop-taps. All new services have been provided with them; and the existing services are being fitted as opportunity occurs. In all, about 2400 are fixed annually; so that at the present time, of the tofal of 29,700 premises within the borough, about 24,000 are provided with these useful fittings. The advantage of outside stop-taps for temporarily shutting off the supply from empty houses as a preventive of waste, will be appreciated from the fact that no less than 1628 were closed last year in consequence of removals, non-payment of rates, and temporary closing of houses during absence from home of the occupiers. The advantage, too, of being able to shut off one house for repairs, instead of a number, is considerable. The cost of providing and fixing a ½-inch stop-tap of first-class make, with guard and cover complete, is 11s. 6d. on an old service, and 7s. 6d. on a new.

The stethoscope used in Cardiff is one of straight-grained ash 24 inches long for inside work (house inspection), and 36 inches for street work, conveniently shaped at the top to place against the ear. The results obtained are excellent; and the inspectors have, by sounding along the ground and without direct contact with the pipes, located leakages so small as to be almost invisible when uncovered. Waste may be classified under three heads: (1) That due to overdrawing and leaving taps running after use; (2) defects in mains and service-pipes; (3) inferior taps of all kinds and syphon cisterns. For the first of these there appears to be no remedy. It must always happen that a certain proportion of the community will be careless in the use of what appears to them to be, save on very rare occasions, an unlimited supply. Self-closing taps cannot be regarded as a satisfactory cure. An instance may be quoted of some large premises containing 250 self-closing taps, where inspection disclosed the fact that about two-thirds of them were leaking. Defects in mains and service-pipess are a great source of waste, though in point of number they amount to less than one-fifth of the total leakages; and, being for the most part hidden from sight, they may be expected to remain longer undiscovered. Inferior fittings are probably the most fruitful source of waste; and the system of control in this respect exercised by the Corporation only partially mitigates the evil. No system of testing and stamping each fitting has yet been introduced, though it has been under consideration; but all fittings and syphon cisterns must be those of approved makers who have previously deposited sample fittings with the Corporation. It is the duty of a turncock to examine the fittings on a new service before the water is turned on, to see that they are by an approved maker, and that they are equal to the deposited approved sample; but this examination is necessarily very superficial, and therefore unsatisfactory. The requirements of the Corporation with regard to bib or stop taps were quoted by the author, who also referred to some small points which, if carefully observed by the makers, would, in his opinion, immediately result in the number of leaking taps being immensely reduced. It has been the practice in Cardiff for many years to renew the washers of all leaky drawing-taps free of cost to consumers, with the result that, on the average, 11,000 have been repaired annually at a cost not exceeding 2d. per tap. When anything more than the renewal of the washer is necessary, the owner has to do the repairs.

The amount of water sold by meter in Cardiff is nearly 500 million gallons per annum; and all the inferential and positive meters up to 1½ inches are taken out for testing—the other positive meters being tested in position. Estimating the loss that would accrue to the Corporation if the meter-testing were discontinued, and neglecting the loss from stopped meters which would be discovered by the meter reader in the ordinary course of his duties, it would be 12 million gallons per annum, which, at the average price of water sold by meter—9d. per 1000 gallons—represents a sum of £450. This, of course, would be a rapidly-increasing amount if testing were continuously neglected. The annual cost of meter inspection, testing, and repairing, including the renewal of all worn parts, has not up to the present exceeded £350. But this item is now increasing, as further help is required to keep the plant in good order.

The author's conclusions were: (1) That to keep the supply of a district within reasonable bounds, an efficient system of inspection is necessary. (2) That a regular and systematic inspection can be carried on at a very reasonable cost, which will certainly be repaid in the value of the water saved. (3) That the prevention of waste will be facilitated by the introduction of a system of testing and stamping of all fittings. (4) That within certain limits the expenditure incurred by the execution of "free repairs" is warranted by the saving of water resulting.

Discussion.

Mr. W. WATTS (Sheffield) pointed out that Mr. Jenkins had put down the average pressure of the water in Cardiff at 35 lbs. per square inch. For such an important town, this did not appear to him (Mr. Watts) to be sufficient to give the force necessary to send a jet of water on to the highest buildings. It might be said that a low pressure induced less waste; but if they had good fittings, properly supervised, a much higher pressure could be maintained without great loss. He was a little surprised that stop-taps were not introduced before 1890, as they gave a much better command over the supply to individual houses or clusters of cottages. If he could have his own way, he would make it compulsory upon corporations to register the water not only in the separate districts, but more particularly as it left the source of supply. As to the cost of water to the Cardiff Corporation, he supposed the 7·5d. per 1000 gallons included the cost of construction. [The PRESIDENT: Everything.] Still he thought that 7·5d. was rather heavy. Works could be cheapened, where there was a large drainage area, by having a great storage capacity. If the storage capacity was insufficient to bottle up the water coming from the drainage area, then the cost per 1000 gallons must necessarily run up. He did think the time had come when water-works engineers should not only consider the site for reservoir embankments, but also very seriously the storage capacity of the reservoir relatively to the drainage area it controlled. Many reservoirs were constructed inadequate to deal with the water flowing from the drainage area. The results were a terrible waste, and a rush to Parliament every now and again for an increase of drainage area when really the applicants were allowing water to run to waste at their own doors. To this he should put a stop.

Mr. H. PRESTON (Grantham) was not quite satisfied with the method the author had adopted in reaching his conclusions. He had put down the value of the water saved at 6d. per 1000 gallons.

It seemed to him (Mr. Preston) the value of a thing was what they could get for it. If Mr. Jenkins was thinking of a water-works undertaking such as many of the members were in charge of, where if the water was not wasted in the town it was wasted elsewhere, or before the water authorities took it, then the 6d. per 1000 gallons was hardly a proper method of calculating its value. In such cases, or under such conditions, he should only estimate its value as the cost incurred in filtering and pumping; so that possibly the value of the water saved by inspection was not more than 1d. per 1000 gallons. Of course, where an undertaking had reached its limit, and extensions had to be considered, then 6d., or whatever the cost of these extended works might be, could be used as an estimate of the saving by inspection. He did not, however, think it was quite a safe basis; but still the value of inspecting was, as the author had said, extremely great. He agreed that free repairs paid a water undertaking up to a certain extent.

Mr. W. G. Kent (London), referring to a report dealing with the subject by Mr. John R. Freeman, of New York, said in England they had no conception of the waste that the American engineers seemed to think not only permissible but really the right sort of thing. In ten of the principal American cities, the average consumption ran from 60 gallons per head per day in 1870 to about 138 gallons in 1899. The maximum in that period was reached by Buffalo—viz., 280 gallons. Mr. Freeman in his report dealt particularly with the waste in New York. The daily consumption per head there was about 116 gallons; and of this, Mr. Freeman thought, some 70 to 80 gallons represented waste pure and simple. The 70 to 80 gallons was divided in this way: From 30 to 50 gallons were due to defective plumbing, from 15 to 20 gallons to leaky and abandoned service-pipes, and something more than 10 gallons to leaky mains. As to the measurable waste, this, it would be seen, was largely attributed to bad fittings; and it exemplified the great advantage that attached to the English system of having fittings passed and stamped by the water authority of the district. Then, again, in England they might congratulate themselves upon the use of stop-cocks, when they found 15 to 20 gallons per head attributed to leaky and abandoned service-pipes. At the end of his report, Mr. Freeman gave some startling figures. He estimated that the consumption in New York would gradually go up. After doing all that could be done to keep it down, it would not be brought within 150 gallons per head per day; and, using only ordinary means of checking waste, the consumption in 1930 would, he calculated, be 200 gallons per head per day. In New York proper, there were some 833 miles of mains; and in Paris there were 1600 miles. The consumption in Paris was 34 gallons per head per day, as against the 116 gallons in New York. He (Mr. Kent) thought this fact worth mentioning as illustrating what was possible in decent and "indecent" main laying. Mr. Jenkins recognized the importance of dealing with waste; and Mr. Freeman advocated much the same system, only he went a little further. He measured the water at the beginning, measured it through to each district, and he wished to measure it to the consumer. This was a proposal that might not be feasible in England. In most things, Americans did not lack courage and resource; but directly the water engineer in America approached the question of waste, he seemed to be in a position of paralytic impotence. But the English engineer said to the consumer: "Thus far may you go, but no farther." Of course, in America there were more baths than in English houses of the same size; and if in England they approached the American condition of luxurious fittings, they would increase the opportunities for waste.

Mr. W. Ingham said in Torquay, they had, he believed, dealt with the detection of waste in a manner different from any other town in the country. They had only three meters to a population of about 51,000; and they were situated close to the service reservoirs. The principle of the meters was really the Deacon cone; but the method of registering was altogether different. By the ordinary Deacon meter, 500 gallons was represented on a very small scale, and naturally it often meant that small leaks were overlooked; but with their present system, they could tell if there was a leak of 5 gallons per hour going on. Very great difficulty had been met with in constructing these meters. To get rid of the friction of the piston connected to the disc, the pipe was carried up to the level of the service reservoir, so that there was practically no friction whatever in the movement. This was a very desirable thing; and those who worked Deacon meters knew only too well how, when perhaps they had got nearly through a test, they would find the piston had stuck. The cost of his system of testing was about £270 per annum; and every district was tested once in ten weeks. The leakage was about 200,000 gallons per day; and this was 73 millions per annum, which, reckoned at 7d. per 1000 gallons, came to £2149, less the cost of £270. He commented on the large amount this waste, if permitted to continue, would represent in capital outlay. Gardens were a source of considerable waste. He had had a series of tests made for three or four years; and he found that the sum they should receive in excess of what was already paid ran to about £4 10s. per house—£4 10s. less was paid than would be if the water was measured.

Mr. John Shaw (Boston, Lincs.) also thought Mr. Jenkins was wrong in taking credit for all the money he did for the water saved. They were told that in Glasgow the cost of the water was slightly above 2d. per 1000 gallons; and in regard to Cardiff, although the saving was charged out at 7½d. per 1000 gallons, he questioned whether the President was lucky enough to get that price from the Corporation. As to the differences in waste in different towns, he (Mr. Shaw) thought a great deal of that might be accounted for by the habits of the people. Eight years of his life were passed in an old-fashioned town, where the works were then getting on for 50 years old. There was scarcely a stop-tap in the place; but there was everything that would tend to waste. Yet, with 6 gallons per head passed through meters for trade purposes, the consumption at that time only ran to about 14 gallons per head, and in the summer to 15 gallons. The town at one time had been very short of water; and the trouble there was then had impressed itself upon the minds of the people, who ably assisted the Water Company in keeping down waste. Then, some fifteen years ago, a new industry was introduced into the town, and a comparatively new quarter was built and inhabited by importations from another town. This particular district was put on meter; and the consumption ran to 23, 24, and 27 gallons per head per day, while the consumption in the old district remained almost the same as before.

Mr. C. Gilby (Bath) questioned the accuracy at the present day of several of the figures given in the paper as to the consumption of water in various towns; and he thought that the number of water-closets supplied accounted to some extent for the divergencies in the consumption per head. Regarding Bath, he said that unfortunately they had to supply a great proportion of their water at a pressure of 80 to 120 lbs. per square inch; and this had a great effect upon the amount of waste. As to the use of the stethoscope, his men complained that in streets lighted by electric arc lamps it was impossible, owing to the hissing, humming, and dancing of the lights, to detect anything less than a considerable waste of water. For the last twelve years, they had had 24 Deacon meters in use; and now they had 26—25 being in constant use. A diagram was taken from each one every day; and by this means they were enabled to see how, when, and where the water went. He did not know how it was possible by any mere system of night inspection, without the aid of some recording apparatus, to get so readily information every morning as to whether anything had gone wrong. He also referred to the wonderful effects that had resulted in Leicester from the unlimited powers the Corporation obtained many years ago in regard to fittings, which enabled them to specify exactly the kind that should be used. So far as he knew, no one had been able to obtain these powers for many years past. Whatever powers they could get now were subject to the approval of the Local Government Board. They gave them little or no power over existing fittings—in fact, they now obtained nothing more than the General Act gave them. Consequently, they had to put up with fittings that they would like to have swept away. He added that in 1885, when they had an intermittent service at Bath, the consumption exceeded 30 gallons per head. This was reduced in 1894 to a little under 20 gallons; and last year it was 21·86 gallons for all purposes. The trade supply was about 2·8 gallons.

Mr. F. Griffith (Leicester) said that in his town the pressure varied from practically 120 lbs. to about 20 lbs., according to difference of level. In the higher districts the pressure gradually became less; but in the lower districts it was certainly 120 lbs. per square inch. It was quite true they had powers to make regulations. They made them, and they used them; and he should recommend everybody else to do the same. They had no meters of any sort for the detection of waste. The water was simply measured as it came from the reservoirs; and upon that statement they based the consumption per head. The total consumption for all purposes at the present time was about 19½ gallons per head per day, with a constant supply. The water consumers numbered 250,000; there were practically 50,000 houses; and there were between 44,000 and 45,000 water closets. They had night inspection, followed by day inspection. They had authority, after giving the owner six days' notice, to enter and repair fittings if they were not done, and charge the cost of the repairs in due course. If they were not paid, they had power to obtain payment through the County Court. As to the testing of meters, in 1880 he constructed a system of books for the purpose of registering the testing of every meter in the town, and changing the meters every three years whether they wanted it or not. He also had a statement by which he could show the cost of the meter in the first instance, the amount spent on repairs, the position in which the meter had been placed, the work it had done, and the rent received for it. This information was very valuable, as they had six or seven different classes of meter in use. In 1890, he also adopted a system of testing and stamping every water-fitting in use. Their average now exceeded 17,000 fittings tested and stamped per annum; and they allowed no fitting to be used unless it was so stamped. He had had 21 years' experience of the system; and he could strongly impress upon the members the importance of insisting upon the very best class of fitting they could get.

The President (Mr. C. H. Priestley) said the powers they possessed in Cardiff were limited by the Local Government Board; and something like twelve years were occupied in trying to get these regulations passed by the Board. Commencing in 1881, they succeeded in getting them passed (he believed) in 1892; and then they were not much better off. Personally, he

should like to have the fittings in the town tested and stamped by the Corporation. He had asked for this on more than one occasion; but his Committee did not seem inclined to impose any restrictions of that sort. With reference to the interesting information Mr. Kent had given them, he (the President) did not think the maximum average legitimate consumption had been reached in England; and, while they did all that was possible to prevent waste, legitimate consumption ought to be encouraged up to a certain extent. He should like to see the pressure in Cardiff higher than it was. If they had an average working pressure of 20 lbs. additional, it would be a great convenience to them on many occasions. Owing, however, to the configuration of the surrounding country, and the fact of the old Lisvane reservoir being at the elevation that it was, it was impossible to construct the filter-beds at any higher level, and, of course, the pressure in the town was taken from the filter-beds.

Mr. C. SAINTY (Windsor) thought that water authorities were bound by the Water-Works Clauses Act to provide sufficient pressure to take the water to the top of any building in the district.

The PRESIDENT replied that, whether they were bound or not, they could not do impossibilities. He believed by their Local Acts they were only bound to supply to the tops of the houses in the two old parishes of the town; but they could not do it in one or two instances.

Mr. JENKINS, in reply, said he did not see there was any other way of calculating the saving of water than by basing it on the money that had been paid to obtain it. With an increasing town like Cardiff, it meant that, if water could be saved, so much less increased storage would be required eventually. If inspection was neglected, the consumption would go up 10 per cent. per annum at least. The 7·5d. included the interest and sinking fund on the money borrowed, together with the cost of maintenance. Mr. Ingham had said the Deacon meter would only show a flow of 500 gallons per hour. It was true the first line on the diagram indicated 500 gallons. But it was easy to see a consumption as low as 50 gallons per hour; and he (Mr. Jenkins) did not think anything more accurate was required for a large district. In his experience, it was not often the Deacon meter stopped; and he did not think sufficient reason was given by Mr. Ingham for condemning it. Every fitting in Cardiff was examined once in eighteen months. He admitted that the consumptions for various towns as given in the paper were not quite up-to-date; but he had them on pretty good authority. As to his statement that Cardiff was entirely a water-closet town, and that 15,400 were supplied directly through cisterns, he should add that there were 13,000 or 14,000 closets flushed by hand. It would be very interesting if they could get particulars as to the cost of the system of protection adopted in Leicester; he had an idea it was likely to be more than the meter system.

This concluded the discussions at the meeting; and we have now to finish our report by giving some extracts from the lecture by Dr. Elliott on "The Strength of Bricks and Brickwork."

The "New Gas" v. the Electric Light.—The "Electrician" offered last week a few observations on the lecture delivered by Mr. W. H. Y. Webber before the Gas Institute on "The New Gas." Our contemporary thinks that if the proposal put forth by the lecturer were carried into effect, "the ordinary gas-burner would be even less economical than it is at present; and though the competition of the incandescent gas-burner with the incandescent electric lamp might be keener, the electric light would then, without a doubt, be 'the poor man's light.'"

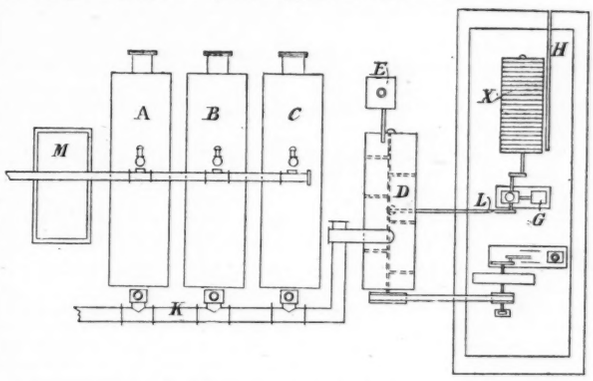
The Lighting of Small Towns.—At the recent meeting of the Municipal Electrical Association at Huddersfield, a paper on the above subject was read by Mr. G. M. Harris, Electrical Engineer to the Bray (Ireland) Urban District Council. The conclusion arrived at by the author was that where gas has been well established, the outlook for a private consumption of electricity will be in inverse proportion to the price charged for gas. Where a high price prevails, the inhabitants will, he said, be found educated to the closest economy in its use; and he added that it is surprising how far economy can, at certain times, be carried.

The Value of Water-Meters.—The use of water-meters, says the "Engineering Record," has caused a saving of $7800 in coal in three years at one of the pumping-stations of the Atlantic City (N.J.) Water-Works, according to the Superintendent, Mr. W. C. Hawley. During this time the population supplied has increased 40 per cent., which makes the saving all the more noteworthy. About 77 per cent. of the services are metered. The value of meters is shown by a case mentioned in the annual report of Mr. John B. Heim, Superintendent of the Madison (Wis.) Water-Works. In a tenement in that city which would be charged $10·50 annually at schedule rates, the meter bills ranged from $2·25 to $6·45 for periods of six months. Another family moved in, and the water bill in one month was run up to $23·40. The family had come from Chicago, where everything was left wide open, and the presence of the tell-tale meter proved a shock. The water was intentionally allowed to run in the water-closet for a part of the time after the first reading of the meter, with the result that the bill was raised to $30·25 for four months.

REGISTER OF PATENTS.

Clarifying the Spent Liquor from Sulphate Plant.—Diamond, W., of Pye Bridge, Derbyshire. No. 15,543; July 29, 1899.

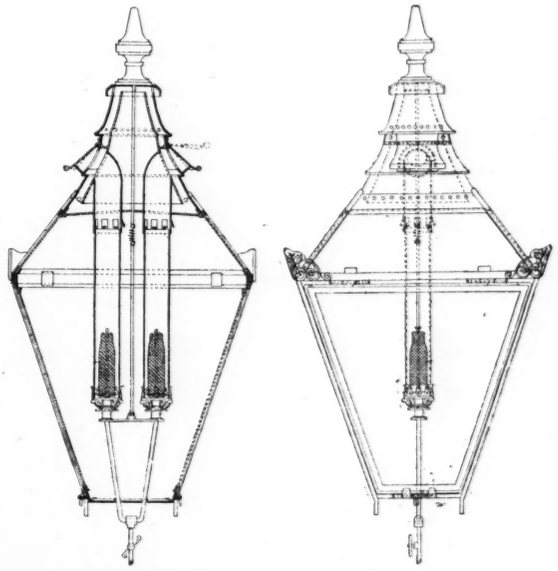
The patentee proposes to conduct the spent liquor into a square brick tank M, below the level of the sulphate plant. Conveniently situated is a pump, the suction-pipe of which is in the tank, and the delivery connected to several large iron tanks A, B, C—the pipe running along the top, with branches leading into each tank; while fitted in the centre of the end of each tank is an outlet-pipe connected to one main K. This main is attached to a tank D, in which is fixed an agitator, worked by a belt and driving engine. Erected above the agitator tank is a small tank E (connected to the agitator), in which is dissolved "aluminoferric cake." To the bottom of the agitator is connected the suction-pipe of a pump G, by means of a pipe L, and the delivery to the filter-press X. The filtrate is conducted by the trough H into the drain.



The spent ammoniacal liquor is run into the tank M, out of which it is pumped into the tanks A, B, C. As one tank is filled, the spent liquor is turned into the other—thus allowing insoluble substances to deposit. When the spent liquor is cool, it is conducted by a tap out of each tank into the main K, which carries it to the agitator D, where it is mixed with a quantity of aluminoferric solution, to clarify it. The whole is then agitated—the mixed liquids being pumped through the filter-press X (where the deposit remains), and the clear liquid running away down the trough H.

Street Gas-Lamps.—Jackson, J., of Leeds. No. 21,457; Oct. 27, 1899.

This invention relates to a lantern for street gas-lighting purposes, provided with an inner lining of smaller size than, but of the same contour as, the top to which it is fixed, whereby an annular or other space is provided for the escape of the products of combustion—the lining



having fixed to its underside a number of pendant tubes corresponding with those of the burners employed, and in independent communication at one end with the chimney of each burner and at the other end with an opening (closed by a weighted door—or its equivalent) in the top of the lantern for igniting each burner separately.

As shown, the lantern is of the usual shape and construction—that is, a metal framework in the form of (say) two truncated pyramidical or other cones placed with their bases towards each other, or provided with any desired number of sides or angles, and glazed in the usual manner, and hinged (if wished) at its top for cleaning and other purposes, as well as for providing access to its interior. The bottom of the lantern is practically closed to the interior, except at the points where one or more gas supply-pipes pass through it to the burners. The top of the lantern is provided with rows of perforations for the admission of air, and for the exit of the products of combustion; also, if so required, it may terminate in a cowl for ventilation purposes, so arranged as to prevent any direct current of air entering the lantern.

Any desired number of incandescent burners are suspended from the

top of the lantern, and each burner is separately connected to the branch of the ordinary supply-pipe. In order to ignite each burner separately, and without passing the torch into the lantern, within the top of the lantern is fixed an inner lining or casing of the same shape as, but smaller than, the inner contour of the top; so that, when fixed in position, there is a space between it and the inside of the top. The inner lining is made to extend some distance above the upper row of ventilation holes in the top, as well as to project below the lowest row of air inlet-holes, but above the tops of the chimneys of the burners.

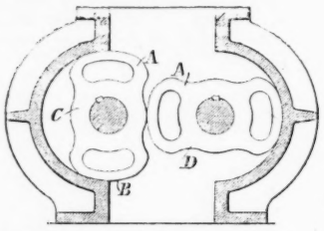
To the inside of the inner lining is also fixed a chimney or tube for carrying away the products of combustion from each burner and mantle without allowing them to pass within the lantern. The tube is made of such a length as to permit the top of the chimney of the burner to pass easily within it; while the upper portion of the tube is so arranged as to be at some distance from, but opposite to, an opening specially provided for it in the top of the lantern. Each of these openings is covered by a weighted door, hinged at its top to the outside of the lantern, so as to prevent any inrush of air down the chimney to the burner, though the lids are so arranged as to be capable of being opened with the igniting torch.

The products of combustion are carried away by the tubes (with which the chimneys of the burners are in communication) into the space between the inside of the top of the lantern and inner lining, and out through the ventilation holes and cowl, without passing into the inside of the lantern below the reflector.

Rotary Pumps and Exhausters.—Allison, C. A.; a communication from the P. H. & F. M. Roots Company, of Connersville, U.S.A. No. 7528; April 24, 1900.

This invention has for its object to increase the strength, tightness, smoothness of working, and durability of pumps or blowers of the Roots pattern.

The usual type of casing is employed, elliptical in cross-section of chamber, and having flat heads, and opposite openings for the inflow and outflow of the liquid or fluid. There are two parallel impeller shafts journalled in the heads, and having their axes at the centres of the arcs of the casing; the shafts being arranged for driving by power in the usual manner. The two lobed impellers A are each fast on its appropriate shaft; the ends of the impellers engaging against the inner faces of the heads of the casing. The outer extremities B of the lobes of the impellers are formed by circular arcs struck from the centres of the shafts, with a radius equal to the distance from the centre of the shaft to the circular arc defining the nearer inner side wall of the casing. The hubs of the impellers C surround the shafts and extend from head to head of the casing; their diameter being substantially equal to the transverse width of the outer extremities of the lobes. The peripheries of the hubs are formed with convex curves concentric with the shafts. There are minor convex curves D at each end of the curves B, forming the side extremities of the lobes. Concave curves join the convex curves; and chambers E extend longitudinally through the lobes, for the purpose of lessening the weight of the impellers.



This peculiar form of impeller is said to result: In a large hub or waist, giving great strength and extended bearing-surface around the shaft-openings through the heads of the casing; in a very extended bearing between the outer extremities of the lobes and the curved inwalls of the casing; in a prolongation of the unchanging character of bearing between the outer extremity of a lobe of one impeller with the waist of the other impeller; in peculiarly smooth and noiseless operation; and in enhanced maintenance of tightness between the extremities of the lobes and the inwalls of the casing, and between the lobes of one impeller and the co-acting surfaces of the other impeller. But the greatest advantage is said to be found "in the unbroken continuity and progressiveness of contact between co-acting impeller surfaces."

APPLICATIONS FOR LETTERS PATENT.

11,465.—French, E., "Mantle supports." June 25.
11,506.—Prescher, H., "Self-ignition of gas." June 25.
11,517.—Archer, D. J., "Self-igniting gas mediums." June 25.
11,525.—Brierley, R., "Improvements relating to gas lighting." June 25.
11,545.—Hamilton, J. H., "Internal combustion engines." June 26.
11,614.—Jacobs, O., "Acetylene gas apparatus." June 26.
11,615.—Himmel, G., "Appliances for gas lamps, lanterns, and the like for exposed or inaccessible positions." June 26.
11,702.—Brooks, J. B., and Holt, J., "Governors for gas and other motors." June 28.
11,762.—Daw, Z. W., "Compressing air and gases." June 28.
11,766.—Glover, J. W., "Gas lighting torches." June 28.
11,788.—Sculthorpe, J., "A means of producing an inflammable gas." June 29.
11,799.—Moodie, R., "Cooling gases and the like." June 29.
11,809.—Boult, A. J., "Burners." A communication from R. Thayer. June 29.
11,810.—Miller, T., "Burners." June 29.
11,858.—Bonnet, J. E., "Guiding gasholders." June 30.
11,865.—Biheller, S., "Burners for incandescent gas-lights." June 30.
11,874.—Thompson, W. P., "Lighters for gases or vapours." A communication from A. Simonini. June 30.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Rating of Water Undertakings.

Sir,—The present method of rating water undertakings is admittedly uncertain and unsatisfactory. Perhaps a full discussion of this very important subject might result in the adoption of principles tending at least to uniformity of practice. I therefore venture to send you a copy of a Memorandum which I prepared for the Royal Commission on Local Taxation in April, 1897, in the hope that you will be able to find room for some extracts therefrom.* The Memorandum, with additions suggested by comments from various quarters, appears on pp. 322-327 of Part II. of the Appendix to Vol. I. of the Minutes of Evidence taken before the Royal Commission.

It seems to me that the one idea to be kept in mind is that the question to be determined is what rent a tenant may reasonably be expected to pay. A rating surveyor now, on the figures of a single year, not unfrequently brings the gross value—*i.e.*, the hypothetical yearly rent—to an amount exceeding the average gross profits of a period of three or five years. Would any responsible tenant pay a rent based on anything but average results? Corporation water-works apparently present a difficulty in applying the method suggested in my Memorandum; but would not their case be met by taking a simple percentage on the structural cost, with the addition of a specified proportion of any profit derived from supplying water to outlying townships?

H. Wilkins.

Lambeth Water-Works, Brixton Hill, S.W.,
July 4, 1900.

The British Association of Water-Works Engineers and the Standardizing of Cast-Iron Water-Mains.

Sir,—I have read with much interest the President's remarks on the above subject, and your comment on same in the "Journal" for June 24 last. There can be no doubt that the standardizing of pipes is a great necessity, and should be undertaken by this Association of practical engineers. I have collected drawings of a large number of different styles of joints—most of them being of a similar type; and one is unable to discover where the difference can be, or how a patent can be claimed for the many shaped grooves or recesses in the faucet.

I have used the ordinary spigot and socket pipe, without bead or groove, for the last thirty years, under pressures from 150 feet to 400 feet, and have never seen the joint blown or even shifted. In a pumping main, if the bends are made as straight as possible, laid in a good concrete bed, the faucet filled with lead, and set up perfectly solid, and the work is done by a good jointer, my experience shows that the numerous devices patented are not necessary. The dimensions of the faucets of all sizes of main pipes have been determined for many years; and a departure from this standard, making the socket less in depth, has sometimes been chronicled in the "Journal" as a leaky main, causing great loss and inconvenience.

If the British Association of Water-Works Engineers should undertake the inquiry on this subject, and publish the result of their conclusions in the "Transactions," I am certain such report would be beneficial to the members, and tend to advance the interests of the Association.

I shall be pleased to exchange my standard list with any reader of the "Journal."

Superintendent.

July 6, 1900.

The Price of Gas Carbon.—A correspondent writes: There is evidently at the present time a keen demand for gas-works carbon, the bulk of which undoubtedly finds its way into the hands of "our friend the enemy" for making electric brushes and pencils. The price has recently risen; but it must again rise to a very much higher figure in the near future. Gas managers have it in their own hands to force up the price of carbon for electric purposes by holding their stock until such times as the dealers are prepared to give £4 or even £5 per ton for it.

The Water Supply of Burnham.—Last Thursday week Colonel Slack held a Local Government Board inquiry at Burnham relative to a proposal of the District Council to borrow £4500 for the extension of the water-mains and erection of new water-works in the parishes of Brent Knoll, Compton Bishop, East Brent, and Loxton. There was no opposition.

How the Lincoln Gas Committee Propose to Meet the Increased Cost of Coal.—The Gas Committee reported to the Lincoln District Council last Tuesday that they had entered into contracts for the supply of 25,000 tons of coal; and in consequence of the increased price, they recommended that the charge for gas to consumers be raised from 2s. 1d. to 2s. 3d. per 1000 cubic feet from Mid-summer. In moving that the Council agree to the recommendation, Alderman Wallis mentioned that he had obtained statistics from 68 other towns, and found that in every case the price of gas was being increased. In one instance an additional 9d. per 1000 feet was being charged, at another town 8d., at a third 7d., at twenty places 6d., at nineteen 5d., thirteen 4d., and eleven 3d.; only two being satisfied with 2d. He therefore thought the Lincoln Council were dealing very fairly with the consumers. They had just entered into contracts for 25,000 tons of coal; and for this they were having to pay no less than £6500 more than last year. The profit last year, but for extraordinary expenditure, would have been about £3000; and the Committee were looking forward to obtaining that sum this year, and also £1500 or £2000 from the sale of coke. This would make a total of £4500 or £5000; and the 2d. extra which it was proposed to charge would bring in about £2000, so that the £6500 extra which was being paid would just be cleared. It was obvious that unless the 2d. was charged, there would be a loss on the year's working. Mr. Horton seconded the adoption of the recommendation, which was agreed to.

* The Memorandum is given, practically in its entirety, in our "Miscellaneous News" columns to-day, p. 106.—Ed. J.G.L.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Private Bills last week:—

Bill read a second time and committed: Oldham Corporation Bill.

Bill reported, with amendments: St. Albans Water Bill.

Bills read the third time and passed: Airdrie, Coatbridge, and District Water Trust Bill, Bedford Gas Bill, British Gaslight Company Bill, Hartlepool Gas and Water Bill, Morley Corporation Bill, Wolverhampton Gas Bill, Woodbridge District Water Bill.

The Lambeth Water Bill, Mid-Kent Water Bill, Portland Urban District Gas Bill, South Metropolitan Gas Bill, and Wandsworth and Putney Gas Bill were referred to a Select Committee, consisting of Lord Brougham and Vaux (Chairman), the Marquis of Zetland, the Earl of Denbigh, the Earl of Mayo, and Lord Plunket; to meet on Tuesday, July 10.

The Rickmansworth and Uxbridge Valley Water Bill was referred to a Select Committee, consisting of Viscount Portman (Chairman), the Marquis of Winchester, the Earl of Romney, Lord Tredegar, and Lord Monckton; to meet on Monday, July 9.

HOUSE OF COMMONS.

The following further progress was made with Private Bills last week:—

Bill read the first time and referred to the Examiners: Morley Corporation Bill [Lords].

Bills read a second time and committed: Bury and District Water (Transfer) Bill [Lords], Gas Orders Confirmation (No. 1) Bill [Lords], Water Orders Confirmation Bill [Lords].

Bills reported, with amendments: Barnsley Corporation Bill [Lords], Glyncorrwg Urban District Council Gas Bill [Lords], Rotherham Corporation Bill [Lords].

Bills read the third time and passed: East Stirlingshire Water Bill [Lords], Perth and Paisley Gas Provisional Orders Bill.

On Tuesday, the Gas Order Confirmation (No. 2) Bill [Lords]—the Dungannon Gas Order—was down for second reading by order; but Mr. P. C. Doogan, the member for East Tyrone, opposed the motion, on the ground that the Order applied for was only intended to strengthen an already too powerful monopoly. As the Local Authority are endeavouring to purchase the gas-works, the President of the Board of Trade (Mr. Ritchie) recommended a fortnight's delay in order that mutually satisfactory terms might be come to. This course was adopted.

On Thursday, a little trouble arose over the consideration of the Lords' amendments to the Spalding Urban District Council (Water) Bill, the object of which is to obtain power to purchase the undertaking of the Spalding Water Company. The question in dispute is as to the compensation of the Engineer and Collector. It is sought to have a clause inserted in the Bill giving them compensation in case of voluntary retirement; but the Council object to this, though they are willing to allow it in case the officers are not retained. The debate was adjourned.

Sir Albert Rollit has placed upon the paper a notice that he intends to call attention to the increases in the prices charged for the supply of gas for public and private purposes in North London by the Gaslight and Coke Company, and to move a resolution.

THE OSSETT CORPORATION AND THE GAS SUPPLY OF ALVERTHORPE.

A Bill to confirm Provisional Orders of the Local Government Board extending the boundaries of the boroughs of Lancaster and Ossett and the city of Wakefield came last Friday before a Select Committee of the House of Commons, presided over by Sir T. Godson. The only opposed Order was that of Ossett; the petitioners being the Wakefield Gas Company. Mr. Wedderburn, Q.C., and Mr. Vaughan Williams appeared for the promoters; Mr. Honoratus Lloyd for the Company. Mr. Wedderburn, in opening the case, said that between Ossett and Wakefield there was a parish called Alverthorpe, for which the two towns competed. Wakefield last year promoted a Bill to extend the boundaries so as to include Alverthorpe; but it was rejected. Afterwards both the towns applied for Provisional Orders; and as the result of an inquiry, the Local Government Board gave a portion of the district to Wakefield and the remainder to Ossett. In the Order it was recited that the whole of the area included in such extension should, for the purposes of the Municipal Corporations Acts and all others, be the borough. In the present session, the Ossett Corporation had promoted a Bill to purchase the undertaking of the Ossett Gas Company. It had passed both Houses, and at present was awaiting the Royal Assent. The position was that when this Bill passed, the Corporation would become the gas authority for the borough; and the extended portion was at present within the limits of supply of the Wakefield Gas Company. This Company was founded in 1822, and in 1847 obtained powers to supply the parish of Alverthorpe. The learned Counsel read the petition of the Company, and contended that they had no monopoly of the gas supply of the district, and that it was in every way desirable that the Corporation should have full powers within its own borough. If the Company desired a protective clause, they should have asked for it when the Corporation Gas Bill was in Committee. Though the Company obtained their powers in 1847, it was not till 1891 that they did anything in the district of Alverthorpe. In that year, after some pressure, they laid a main to supply Roundwood House, the colliery, and brick-works; and so negligently had they performed their duty, that a portion of the area allotted to them had been lighted by the Ossett Company for twenty years. Evidence was given in support of Counsel's statement by Mr. W. Brook, the Town Clerk of Ossett. In cross examination, he admitted that at present the Corporation had no power to compete with the Wakefield Gas Company. The Chairman said it appeared to him that the whole thing was a "storm in a tea-cup." The entire gas supply of the district only came to £102 per annum, and it was steadily decreasing. Mr. Wedderburn offered to give up all their present customers on the understanding that the Corporation should have power to purchase the Company's interest at some future time. Mr. Lloyd said the Company opposed on the question of principle. The whole point was whether, by an extension of the borough, the Corporation should be empowered to come into their area and compete with them. He went at length into the rights conferred on corporations by the Public Health Act, and instanced Huddersfield. In that case, Ravensthorpe extended its boundaries, and commenced to lay mains to supply water in the added area, which was within that of the Huddersfield Corporation. The Corporation applied for an injunction, which was refused by Mr. Justice North, but granted by the Court of Appeal. He asked that a proviso should be put in the Order to clearly define the Company's rights. The Chairman said the Committee would agree that Ossett should not supply gas within a line drawn from the outside of the present mains of the Company. Mr. Lloyd said in that case he would take no part in the discussion of the clauses, and reserved his right to oppose in the other House. The Bill was then ordered to be reported.

ROTHERHAM AND THE RAWMARSH WATER SUPPLY.

The Rotherham Corporation Bill (which was an Omnibus Bill dealing with an extension of the borough, the construction of tramways, street improvements, gas, water, and finance) was, on the 2nd inst., considered by a Committee of the House of Commons presided over by Sir F. Godson. The only opposed portion was that relating to the water undertaking of the Corporation, and was contained in Clause 95. This reads as follows:—

(1) Notwithstanding the terms of the agreement dated the 17th day of December, 1869, and made between the Local Board of Health for the district of Rotherham and Kimberworth and the Local Board of Health for the district of Rawmarsh (which agreement was scheduled to, and confirmed by, the Act of 1870), the Corporation shall, on and from the 25th of December, 1901, be under no obligation to supply to the Rawmarsh Council water from the water-works authorized by the Act of 1863. (2) If before the 25th of December, 1900, the Rawmarsh Council, by notice in writing under the hand of their Clerk, so required, the Corporation shall, after such 25th of December, 1901, supply to the Rawmarsh Council water of the same quality, and from the same sources, as that used in the domestic supply of the borough, at the cost price to the Corporation; such price in case of dispute to be determined by an Arbitrator appointed by the Local Government Board.

Prior to 1863, the only supply of Rotherham was from the Wellgate spring in the centre of the town. In that year, the Local Board obtained powers to impound the waters of the Dalton Brook and of the Ulley Brook, and construct a reservoir of a capacity of 150 million gallons to supply the town. Both these watersheds were outside the limits of Rotherham and Rawmarsh; but they were on the Rotherham side of the Don. In 1870, the Local Board again went to Parliament for gas powers, and for an extension of time for the construction of the works authorized by the Act of 1863. Attached to the Bill was the agreement to supply Rawmarsh with water in bulk at a charge of 6d. per 1000 gallons; and the Bill at the same time made Rawmarsh a Water Authority, and gave it the usual powers of supply. At that date, Rotherham was constructing this large Ulley reservoir; and it was anticipated that they would be able to supply Rawmarsh for many years. What had really happened could not have been then foreseen. In 1891 and 1892, the sources of the water supply became open to suspicion. There was an epidemic of typhoid fever in the district; and, on the complaint of Rawmarsh, the Local Government Board in 1893 sent down an Inspector—Dr. Theodore Thompson—who condemned all the sources of supply, and recommended that as soon as possible, the Ulley reservoir should be discontinued. It thus became a public duty for Rotherham to get a new source of supply; and they obtained temporary assistance from Sheffield. In 1896, they went to Parliament with Sheffield, who sought powers to construct the Langsett reservoir in the Little Don Valley. By agreement under that Act, Rotherham was entitled to a supply of water rising from 500,000 gallons to 1,600,000 gallons daily. This water they got from Sheffield at cost price, *plus* ¼ per cent. Last year Rotherham joined Sheffield in applying for the Derwent Valley Water Scheme, and secured the right to a share of the portion allotted to that city. When Sheffield obtained the supply, Rotherham would be entitled to an extra quantity of water at a charge of 7½d. per 1000 gallons. The change in the water supply had been a great cost to Rotherham; and in selling to Rawmarsh at 6d. per 1000 gallons, they had sustained considerable loss. The average deficit for the last thirteen years had been £2000 per annum, which had to be met by the profits of their gas undertaking and by the general rates. The question was whether they were bound to go on supplying Rawmarsh with water from sources not in existence or contemplated at the time of the agreement. If they had to continue to supply water, they sought that the price should be revised. They had asked in the Bill that the price should be 9d. per 1000 gallons; but in the other House they had agreed to accept the cost price. It was inequitable that they should incur any loss from circumstances entirely beyond their control. Evidence in support of the opening of Counsel was given by Mr. H. H. Copnall, Town Clerk of Rotherham, and Mr. C. H. Marsk, Borough Controller. Mr. W. Terrey, General Manager of the Sheffield water undertaking, said since 1892 there had been a great change in the Dalton gathering ground, in consequence of the extension of agriculture and the opening of a large colliery. The whole cost of water supply had during the last thirty years increased from 30 to 40 per cent. The cost of the water at Sheffield had risen from 6d. to 8½d. per 1000 gallons. He estimated the Little Don Valley water would cost 5½d. per 1000 gallons; and to this must be added 2½d. per 1000 gallons for interest and sinking fund on the existing mains and works—making the price to Rotherham 8d. per 1000 gallons. Sheffield was at present supplying the Wortley Rural District Council at 7½d. per 1000 gallons; and the Parliamentary Committee fixed the price of the Derwent Valley water to Rotherham at this figure, *plus* 4 per cent. on the cost of the mains and pipes. Mr. James Mansergh, who had assisted in carrying out the works under the Act of 1863, said at that time the sources of supply were considered good. The price of water had risen immensely since the time the agreement was made. He considered the offer to supply Rawmarsh at cost price was a very fair and liberal proposal. It was only reasonable that they should take the burden as well as the benefit of the water undertaking. Mr. Moon contended that Rawmarsh was entitled to have the agreement continued, and that in any case they should not be required to pay the cost of any sinking fund. The Committee agreed to allow the clause, deferring the date of the proposed revision of price till Christmas, 1903. The remaining clauses were then gone through, and the Bill was ordered to be reported.

THE PARLIAMENTARY COMMITTEE ON MUNICIPAL TRADING.

The Joint Committee of the Houses of Lords and Commons who are inquiring into the subject of municipal trading (see *ante*, p. 33) continued their proceedings on Tuesday last, under the presidency of the Earl of Crewe.

The first witness was Sir Thomas Hughes, Alderman of the Liverpool City Council, who stated that, as a result of his 23 years' experience and observation of municipal trading in the city, he had come to the conclusion that there were many concerns, called by some people "commercial undertakings," which were best promoted and carried out by a corporation. He made this statement on the ground that a public body could obtain their capital at a much cheaper rate of interest than a private one. They practically made the people they represented partners in the concern, and therefore they became interested in its welfare, and supported it. A corporation had no dividends to declare; and he believed there were many men who devoted their public life to carrying on these undertakings rather than ally themselves with private enterprises. He had himself served the public for 23 years, although he had had many inducements to become a director of private concerns. The undertakings conducted by the Corporation which came within the scope of the Committee's inquiry were tramways, electric lighting, water supply, public baths, workmen's dwellings, and open spaces. Asked if he saw any danger in allowing corporations to transfer profits from their undertakings to the relief of the general rates, he replied: "I think that no municipality ought to look to assisting its rates out of undertakings of this sort until they are on a thoroughly sound basis. There ought not to be too great a temptation to create these undertakings simply to make profits for the relief of the general rates. Directly your undertakings are making steady profits, and the accumulation for the reserve fund is sufficient, then I see no harm in a municipality being allowed to devote the profits for the relief of other rates; but I would not allow this when the undertakings are in what I may call a speculative position." Dealing with the electric light undertaking, witness stated that the Corporation purchased it in 1896 for £400,000; buying for this sum what had cost the selling Company £250,000. He made no complaint, however, in this particular. They had greatly reduced the prices to consumers; and being able to work the two businesses of tramways and electrical supply together, they were in a position to obtain energy for the trams at less than 1d. per unit. They realized a profit of £11,000 last year, in spite of the reductions made in the charges. Under no circumstances could they allocate more than 5 per cent. of the profits to the reduction of the rates. If they showed a profit of more than 5 per cent., they must reduce the prices. Questioned with regard to the water supply, witness said the total debt of the Corporation on this account was £4,569,590. The amount was about equally divided between the Rivington and Vyrnwy schemes. There was a fixed water-rate of 3d. in the pound on the rateable value of houses, in addition to a water-rent of 7d., which might vary according to the necessities of the undertakings. They were debarred from levying rent which would do more than meet their actual needs. Liverpool would compare favourably with London, not only in the supply of water to private consumers, which was unlimited, but also for trade and shipping purposes. One great consideration in giving a municipality control of the water supply was the necessity of preserving its purity. In Liverpool, the poorer citizens were encouraged to use water as freely as possible, on sanitary grounds. The realization of a profit was no object with them. He would not mind incurring a loss on the water supply, as water-works and baths were undertakings on which they might face it in the interests of the community. Asked how he drew a distinction between making a profit on the supply of electricity and not of water, he replied that water was an essential of life; it was consumed by everybody—rich and poor alike. Gas or electricity was a commodity consumed only by a portion of the ratepayers. The Chairman questioned if this was absolutely so. He thought that when electricity became cheaper, there was every possibility that the poor would use it. Witness said one would have thought the same of gas; but a large part of the poor had never used it, and still depended for their light upon candles and oil. He would certainly not uphold municipalities undertaking public bakeries, though this had been advocated. He thought certain things had been asked for which were ridiculous. He was bound to admit, however, that one could not lay down a hard-and-fast line as to what ought and what ought not to be allowed, because the circumstances of each community must be borne in mind. He considered the best authorities would be, first of all, the permanent officials; and then the Houses of Parliament should say, when a municipality had made application through a Bill, and all the evidence had been heard, whether or not, under all the circumstances, the undertaking was one they should carry on. He would certainly not allow the ratepayers to be the judges. Having referred to the markets and baths and wash-houses, witness gave some particulars of the work done by the Corporation in the clearance of insanitary areas and the erection of workmen's dwellings. The Corporation had, he said, avoided becoming builders themselves wherever they could get private enterprise to undertake the work. But the Municipality would always have to supplement private enterprise; and this was one of the subjects which they might very well be left to deal with, having regard to their obligations to those whom they represented. Replying to general questions, witness said he had always foreseen the danger arising from the growth of the number of municipal employees who had votes. For this reason, he had never cared to encourage municipal undertakings beyond what was actually necessary. He should not regret to see it part of the conditions upon which men took employment under municipalities that they did not exercise their votes while so employed. He did not see that there would be any great hardship if, when a man became an employee of a corporation, he should cease to have a vote in the choice of his master.

Alderman J. W. Southern, of Manchester, who was the next witness, described the position of the water supply in that city. He said the capital invested, inclusive of money borrowed, was £6,009,357. Of the borrowed capital, £1,156,869 had been paid off. The balance of capital outstanding on March 31, 1899, was £4,908,490. The average annual income for the five years ending March 31, 1898, was £273,327; the average annual working expenses for the same period being £70,300. There was an annual gross profit of £203,027, out of which a sum of £199,929 was taken in respect of principal and interest. While the combined water-rates (public and domestic) had never exceeded 1s. in the pound on the assessment, and the water-rents outside the city had never been more than 1s. in the pound on the rental, the surplus revenue in 1899 reached a sum which justified the Committee in remitting water charges to the extent of £35,000 per annum. The water-works had never involved any charge upon the city rate. On the other hand, no profits had been handed over in relief of the rates. The supply of water under hydraulic pressure to small manufacturers, started in 1891, had been attended with gratifying results. The Local Authority of Manchester had supplied gas since 1817. The total amount expended on these works was £2,037,966. There was a balance of borrowed capital outstanding on March 31, 1898, of £1,058,988. There was an average annual income of £555,597 for the five years ending on that date; the average amount of the working expenses was £450,085; and the gross profit, £105,512. The surplus profit had been for many years carried to the credit of the city rate. The Corporation had statutory power to manufacture and deal with the residual products, and were erecting plant for the manufacture of sulphuric acid and sulphate of ammonia. They also sold, hired, and dealt in apparatus for using gas for cooking, heating, and motive power, under statutory authority. This was attended with considerable advantage. A large quantity of gas was supplied for motive power. The gas-engine had been a useful agent in reducing the pollution of the atmosphere by smoke. During a period of fifteen years, £788,319 of gas profits had been applied to city improvements, while £631,494 had been written off. The price charged for gas had been 2s. 6d. per 1000 cubic feet within the city, and 2s. 9d. in places beyond it; but it would be raised, owing to the increased price of coal. The average price had been 3d. per 1000 feet less than in Liverpool. The differential charge in Manchester was justified on various grounds.

At the meeting of the Committee on Friday, Alderman Southern continued his evidence. He explained that the Corporation, who had constructed the tramways, had determined to work the undertaking themselves by electricity upon the expiration of the existing Company's lease in 1901. They had also made arrangements for working the tramways of certain urban districts adjacent to Manchester with the city tramways—the Corporation to pay a rent to the urban authorities. They had expended a capital sum of £787,600 on the markets, abattoirs, wharves, and lairages, the revenue from which had always exceeded the expenditure. The surplus had been transferred to the city fund in aid of the rates. The Corporation had erected cold-air stores at a cost of £80,718, and these had resulted in the preservation of food which would otherwise have become unfit for consumption. They had also made a loan of £5,000,000 to the Manchester Ship Canal Company, which had involved a rate of something over 1s. in the pound. This had been ungrudgingly paid; and it would, he thought, gradually diminish and ultimately vanish. The electrical undertaking of the city was owned by the Corporation, and last year the gross profits accruing were £36,292, equal to 6·41 per cent. on the capital invested. The charges to consumers had been greatly reduced. There was an impression that electrical power was chiefly sought by the large manufacturers. They found it was precisely the other way, and that it was the small consumer who wanted and obtained it. He should say that, wherever an enterprise involved interference with the streets, it was very desirable that it should be in the hands of the Local Authority. Beyond this, he should say that every application for powers should be tested upon its merits, because the character of towns differed in such a degree that any rigid rule would be inapplicable to all. Alderman D. G. Ward, of Harrogate, and Mr. Davis, Secretary of the Chesterfield Chamber of Commerce, also gave evidence, and the Committee adjourned.

CORPORATIONS AND THE SUPPLY OF ELECTRIC POWER.

The Select Committee, presided over by Sir James Kitson, who have had before them the Durham, Tyneside, Lancashire, and South Wales Electric Power Supply Bills, met again last Tuesday to consider the clauses drafted to carry out their decision of the previous Thursday (*ante*, p. 32). After they had deliberated in private for nearly two hours, the public were admitted and the Chairman said: I have to make a statement which is an expansion of the previous declaration of the Committee on the South Wales Electrical Power Distribution Bill. It is as follows: "(1) The Company to be authorized to supply electrical energy for power purposes anywhere within the area of supply, subject to the consent of the local authority in certain cases as set out below. (2) The Company to have no general lighting powers—*i.e.*, distribution to ordinary consumers—within the area, except in pursuance of a Provisional Order obtained in the ordinary way. (3) Where a local authority are now authorized to supply electricity within the area, their consent is to be required for the supply of electricity by the Company; the Board of Trade to be empowered to override the refusal of the local authority to give consent, if the authority are not prepared to provide the requisite supply on reasonable terms and within a reasonable time. (4) Any local authority which hereafter gets statutory powers for supplying electricity within the area to have, in ordinary cases, the option of taking over the Company's supply in its local area on terms to be laid down by the Provisional Order or Act by which the statutory powers are given. (5) A company having statutory powers to be in the same position as a local authority not having statutory powers; a company to whom powers are hereafter granted to be placed in the same position as a local authority to whom statutory powers are hereafter granted." That is the decision of the Committee, and it is suggested that the Government Draftsmen should meet the Parliamentary Agents and go through the clauses of the Bill; and the Committee will meet to-morrow in the hope of being able to settle clauses finally.

The Committee met again on Wednesday, when the Chairman announced that, in principle, the clause drawn by the Board of Trade carried out their declaration. Counsel addressed the Committee on the clause, and suggested various amendments. The Committee consulted in private for upwards of an hour, and, the public having been admitted, it was stated that the clause had been drafted finally as follows: "The powers of the Company for the supply of electricity under this Act shall

be subject to the following provisions: (1) Electricity shall be supplied under this Act only (*a*) for supply in bulk to authorized distributors and (*b*) for the purpose of providing power and for the lighting by any person to whom it is so supplied for power of any premises in any part of which the power is utilized. (2) Electricity shall not be supplied under this Act by the Company in any area being at the passing of this Act the area of supply of any authorized distributors, except with the consent of those distributors; but that consent shall not be unreasonably withheld. If any question arises whether that consent is unreasonably withheld or not, the question shall be determined by the Board of Trade. The consent shall be deemed to be unreasonably withheld if the authorized distributors are not willing and in a position to give the requisite supply upon reasonable terms and within a reasonable time; and, in considering what are reasonable terms and what is a reasonable time, the Board of Trade shall, amongst other things, have regard to the terms upon which, and the time within which, the Company are willing and in a position to give the supply. (3) If at any time after the passing of this Act any local authority or company become authorized distributors in any area within the area of supply under this Act, the Company shall be subject to any provisions which may be made by the Act or Provisional Order under which the distributors become authorized as to the taking over of any supply then given by the Company for use exclusively within the area of supply of the distributors. (4) Nothing herein contained shall prevent a company from applying for Provisional Orders under the Electric Lighting Acts of 1882 and 1888. (5) Nothing in this section shall authorize a company to supply electricity for lighting other than the lighting specially mentioned in this section. In this section the expression 'authorized distributors' means any local authority, company, body, or person authorized by Act of Parliament or Provisional Order confirmed by Parliament to supply electricity within the area of supply."

When the Committee assembled on Thursday, the chief matter considered was the maximum dividend to be paid by the several Companies. Mr. H. Lloyd, on behalf of the Local Authority of Barry (South Wales), asked the Committee to amend the clause adopted on the previous day so as to provide that a company should not lay distributing mains in any area, which at the passing of the Act was the area of supply of any authorized distributors, except with the consent of those distributors. The Chairman said the Committee declined to amend the clause. Mr. Lloyd said his clients regarded this as a question of principle; and after the decision of the Committee they would take no further part in the proceedings. Mr. Fitzgerald, Q.C., then raised the question of dividend. He explained that by the South Wales Bill a dividend of 10 per cent., with a sliding-scale, was provided for. His proposal was that, whenever during any year the price actually charged by the Company for energy should have been, on the average of the year, above the standard price, the dividend should, in respect of each 1·20th of a penny per unit by which the actual average price should have risen above the standard price, be reduced by 5s. for every £100 of paid-up capital. The Chairman said the learned Counsel need not argue the question. The decision of the Committee was that the maximum dividend payable should be limited to 8 per cent. cumulative, without a sliding-scale. There would be a clause embodying this decision, and giving the Board of Trade power of revision at the end of ten years. If the fuller knowledge and experience then gained justified the change, the Board would have power to sanction a sliding-scale if it were found necessary. Mr. Moon, who at a late period appeared before the Committee in reference to the County of Durham Bill, said that, if this was the final and irrevocable decision of the Committee, the promoters would have seriously to consider whether the Bill would be worth taking. Mr. Ram, Q.C., said the retention of the sliding-scale was absolutely vital to the South Wales Bill, and the promoters were convinced that without it there would be no possibility of raising the necessary capital. Mr. Pollock, Q.C., pointed out that in the case of the Lancashire Bill none of their opponents objected to the adoption of the sliding-scale principle. The Committee consulted in private, and subsequently announced that they would hear further arguments on their proposal. These having been adduced, and the Committee having again deliberated in private, Sir James Kitson said the Committee adhered to their decision that the standard dividend should be fixed at 8 per cent.; but, having heard the arguments of Counsel, they agreed that a sliding scale should be adopted, its principle being 5 per cent. discount from the amounts charged on the rise of the dividend by 1 per cent.—the sliding-scale and standard prices charged to be subject to revision by the Board of Trade after a period of ten years.

On the re-assembling of the Committee on Friday, one of the first questions raised was with reference to the decision come to that the standard dividend and the standard price should be subject to the revision of the Board of Trade in ten years from the passing of the Act. It was urged by Counsel for the South Wales Bill that the Board of Trade clause should be so amended as to provide merely for the revision of the standard price, leaving the standard dividend as fixed by the Committee at 8 per cent. A long argument ensued upon the following clause, drafted by the Board of Trade, for insertion in all the Bills: "If within one year from the date of the passing of this Act the Company have not substantially commenced their works for the purpose of carrying out their powers under this Act, and if within three years after the date of the passing of this Act the Company have not erected a generating station or generating stations sufficient in the opinion of the Board of Trade, and are not in a position to supply therefrom, the Board of Trade may order that the powers of the Company under this Act shall cease; and on any such order being made these powers shall cease accordingly." Counsel for the three promoting Companies expressed their willingness to accept the clause, if the one year was altered to two years and the three years to five years. Other points having been discussed, the Committee had a long deliberation in private. When the public were re-admitted, the Chairman said the decision of the Committee was that the standard dividend in the case of the South Wales Bill should not be subject to revision, but that the relation between price and dividend fixed by the Committee on the previous day should stand. With regard to the cessor clause, two years and four years would be substituted for one year and three years. In the South Wales Bill the maximum price would be reduced from 4d. to 3d., in accordance with the offer that had been made by the promoters.

The further proceedings were adjourned.

THE LEA CONSERVANCY BOARD AND THE LONDON WATER SUPPLY.

The Bill promoted by the Lea Conservancy Board to sanction the reconstitution of that body and the provision of further funds to enable them to carry out more efficiently the duties entrusted to them, has lately been under consideration by a Committee of the House of Lords presided over by the Earl of Rosse. The measure was considered at great length by a Committee of the House of Commons early in the session; there being seventeen petitioners, representing a variety of interests, against it. A summary of the proceedings, so far as they bore upon matters with which our readers are concerned, was given in the "JOURNAL" for May 1 (p. 1134). The result of the inquiry was the passing of the preamble of the Bill. As it left the Commons, the contributions of the New River and East London Water Companies to the funds of the Conservators had been increased to £8000—£3750 from the former and £4250 from the latter; while the total representation of the Companies on the Board was reduced from four to two members. Intimation was given that the Bill would be further opposed on these points in the Upper House; and accordingly when it was in Committee Mr. Claude Baggallay, Q.C., for the New River Company, asked for a decision on two points—first, whether, in view of the fact that the promoters' witnesses had admitted that the change in the Board was unnecessary, the Committee would not dismiss the reconstitution portion of the Bill; secondly, as to whether, in view of the statutory arrangement come to with the Water Companies years ago, there was now any right to reopen the question of their payments to the Board. Mr. Worsley Taylor, Q.C., for the promoters, protested against the action of the Companies in seeking to stop the Bill. The Committee, however, decided to hear the opponents. In support of the Companies' case that they ought not to lose any portion of their present representation, or be called upon to contribute any further amount to the expenses of the Board, the evidence of the Engineers to the two Companies was heard, and Mr. Pope, Q.C., and Mr. Claude Baggallay, Q.C., addressed the Committee. In the end, the preamble of the Bill was passed.

Bursting of a Reservoir in Michigan.—According to a telegram received through the Central News Agency, the water reservoir at Grand Rapids, Michigan, burst on Monday last week, and upwards of 100 million gallons of water rushed down the valley, carrying everything before it. Hundreds of dwelling-houses were entirely destroyed, and many of the inhabitants had miraculous escapes. But despite the fact that the population numbers over 9000, only one life was lost.

Bangor Gas Profits.—The fact that the Bangor gas undertaking earned a net profit last year of £1080, in spite of the increase in the price of coal, appears to have given a great deal of pleasure to the members of the City Council; for, in a report to hand, we are told that when the Mayor made an announcement to this effect at a meeting of the Council on Wednesday, the members heartily cheered. The price of gas is not to be increased, although the tenders already accepted for coal amount to £1000 more than last year.

Gas and Electricity Finances at Blackpool.—Dealing with the finances of the borough for the past year at the meeting of the Blackpool Town Council on Tuesday, Alderman Heap stated that for the Electricity Department a profit of £2295 had been estimated, but only £1176 had been received, or nearly 100 per cent. less. The gas profits were exceedingly creditable, when it was remembered how coal had increased in price. He thought it should be mentioned to the credit of the Gas Committee that they foresaw the rise and covered their requirements almost wholly by contracts. It was estimated that they would make £10,000; and they actually handed over £12,000, with a handsome balance for the rates of the present year.

The Nitrate of Soda Market in the Past Six Months.—We learn from Messrs. W. Montgomery and Co.'s half-yearly nitrate of soda report that the actual consumption in Europe for the six months last closed amounted to 848,000 tons—almost precisely the same quantity as last year, without taking into account the fact that the interior stock on the Continent in the hands of dealers at the beginning of the season was at least 20,000 tons more than was the case twelve months previously. The visible supply to-day amounts to 298,000 tons, as compared with 326,000 tons last year. The market opened in January with the spot value for cargoes at 7s. 9d. per cwt.; it closes firm at 7s. 11d. to 8s. for due cargoes, with summer and autumn shipments at 8s. 1d. to 8s. 3d.

Comparative Cost of Illuminants for Village Lighting.—The question of public lighting for the parish of Mangotsfield has been considered at a meeting of the Parochial Committee; and the following figures as to the cost of installing the various competing systems of illumination were presented: Oil, initial cost, £256 10s.; rate per annum (all night lighting), 4¼d. Acetylene, initial cost, £651 12s.; rate per annum, 6d. Gas (old burner), initial cost, £369; rate per annum. 4d. Gas (incandescent), initial cost, £331 4s.; rate per annum, 3½d. Electricity (gross), initial cost, £6400. Electricity (net), rate per annum, 4d. It will be noticed that incandescent gas lighting would commit the parish to the lowest rate per annum; but the matter, so far as we have seen, has not yet been settled by the Committee.

Gas Affairs at Loughborough.—Reporting at the meeting of the Loughborough Town Council yesterday week on the affairs of the gas undertaking, the Parliamentary Committee stated that they had considered the charge for gas for public lighting in the borough, and had decided that it be increased 6d. per 1000 cubic feet as to other consumers and as would be the case under the agreement hitherto existing with the Gas Company. The Committee had also mutually agreed with the Company to the appointment of Mr. Thomas Berridge, of Leamington, to value the gas, coal, and other tenant's stores which had to be taken over by the Corporation on the transfer of the undertaking. Regarding the transfer, the Committee had entered into an agreement, subject to the necessary sanction, to pay the purchase money for the gas undertaking on Sept. 29 next, and to take over, and enter into possession of, the works as from June 30—the Corporation to pay interest on the purchase money at the rate of 4 per cent. per annum from June 30 to the actual date of payment. The report was adopted.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Monday, July 2.

(*Before Mr. Justice* BUCKLEY.)

In re Kern's Patent No. 294 of 1897.

On the resumption of the hearing of the above-named case, which was commenced on the 29th ult. (see *ante*, p. 34),

Mr. *Dugald Clerk* was further cross-examined. He said his Assistant had tried, by means of a meter, some further experiments as to the velocity with which a self-burning mixture passed through a burner, and he understood that they supported his previous statement; but he could not speak to them personally. The best explosive mixture was 1 to 5; but this did not give complete combustion. There was an advantage in dispensing with the chimney; but he could understand that a chimney might improve the light by steadying the flame, especially with a low pressure. The Kern burner without the chimney gave 25 candles per cubic foot, against 18 candles from an ordinary Welsbach. The witness was then examined as to the action of drawing in the air in the two cones. He did not agree that anything was due to friction, or that the length and angle of the upper or mixing cone was not of great importance. The perforated box or colander which surrounded it had a great effect on the mixing, causing eddies in the mixture. He was aware that in Paris the ordinary gas pressure was much higher than in London; but he did not think this would materially affect the length of the cone, because the jet would require to be smaller. It would affect the length of the cone to some extent. De Mare's reference to a batswing burner showed that he contemplated burning a mixture very poor in air. Similar language in Kern's specification did not indicate this, because he referred plainly to the use of a self-burning mixture. It was quite true that De Mare described a method of producing the requisite mixture and velocity. His experiments showed that the angle of the upper cone was important, and that the angle of 10° specified was the best. He judged by the character of the flame; he had not tested the illuminating power. Some further questions on the results of Professor Smithells's experiments on self-burning mixtures concluded the cross-examination.

Re-examined by Mr. MOULTON, witness said he had had large experience in questions connected with gas, both theoretical and practical. There would be no difficulty about a competent workman following out the descriptions in Kern's specification. By following these descriptions, the results claimed were fully obtained—an increased illumination for the same combustion of gas, and without a glass chimney or other means of producing a current of air. It gave a higher degree of incandescence in the mantle. As worked in practice, the residual gases which burned at the tip or exterior of the flame were very small in proportion to the total quantity. The light evolved from an incandescent mantle rose rapidly with increase of temperature. Prior to Kern, he knew of no paper pointing out the advantage of having a larger proportion of air in the mixture than that present in the ordinary bunsen flame (about 2·4 to 1). The heat of the flame in the Kern burner did not depend on the supply of oxygen externally. The hottest part was just inside the exterior surface; and this was just where the mantle was placed. The re-examination was continued for some time, but mainly to the same effect—that the specification was clear in its directions and accurate in its statements of the results produced.

An experiment was shown of a Kern burner placed inside a tall chimney fitting air-tight round it at the bottom, so that no external air could reach the flame. At the top the chimney was closed, except for a short brass tube through which the residual gases passed, burning with an almost invisible flame. The light emitted was very brilliant; and a small mantle held in the residual flame was scarcely heated at all.

Mr. BOUSFIELD pointed out that the burner employed was improved in several respects, and that the mantle used was not suitable for the size of the burner.

Mr. MOULTON replied that the experiment was only shown for a specific purpose, with which the considerations mentioned had no connection.

Re-examination continued: He had made many experiments besides those he had described, and they all gave similar results. He for various reasons took the drawings attached to De Mare's specification to be full size. The model produced by the petitioners was four times the size, and such as no workman would think of making. Such a brobdignagian burner ought to consume 12 cubic feet an hour; whereas it only burned 4½ feet. The other model also was quite out of proportion, and even then did not produce a satisfactory result. De Mare said nothing about a chimney one way or the other. There was nothing to show that he intended to work with anything but an ordinary bunsen flame, of about 1 part gas to 2 parts air. A batswing flame was supplied freely with air on both sides; and if it were a self-burning mixture to start with, it would get so much additional air from outside as to be very much reduced in temperature. It would therefore be useless. There was no real mixing-cone in the De Mare burner. Witness did not find any anticipation of Kern in Horwitz or Moul. The latter did not use a self-burning mixture at all, but supplied air to the interior of his flame. In his comparative experiments, he had used the best available mantle for the particular burner.

By Mr. BOUSFIELD: He was not aware that the drawings to De Mare's specification in the Patent Office were only half the size of the French originals. The blue print shown him appeared of exaggerated size.

Mr. *Matthew A. Adam*, B.Sc., Assistant to Mr. Dugald Clerk, was the next witness. He said he made a series of experiments on Saturday as to the passage of air and gas through the long glass tube. He found a slight error in the previous results of about 18 per cent. The true ratio was about 5·6 to 1, instead of 6 to 1 of air; there being an arithmetical error on the other side which partially corrected it. This measurement was arrived at with an aspirator. Other experiments made with a meter gave the proportions as 5 to 1 and 5·2 to 1. The illuminating power he found to be 60 candles and 57; the consumption being 2½ cubic feet per hour. In a third experiment, using air in the proportion of 3 to 1, the candle power fell off to about 10 per foot. He had attempted to repeat the experiment with the De Mare burner which had been shown, with a Kern burner, with a tall chimney surrounding the mantle so as to prevent the access of air; but he could not succeed.

Cross-examined: There were slight inaccuracies in the original method of estimation; but all possible means were taken to eliminate them. He should think they were reduced to 3 per cent. He could not say the tests were absolutely accurate.

Mr. BOUSFIELD suggested that some experiment should be made under joint control, so as to obtain figures which would be beyond dispute, to establish what was the proper mixture of gas and air for producing the best illuminating result.

After some discussion, it was agreed that such experiments should be made in the petitioners' consultation-room in the presence of his Lordship and Counsel and experts on each side.

Mr. MOULTON suggested that the experiments should be first rehearsed before the experts, so that each side should know what points were supposed to be established.

It was then arranged that the case should be adjourned for this to be done; and that the experiments should be repeated in his Lordship's presence the following morning.

Tuesday, July 3.

When the Court sat this morning, it was announced that the experiments were very nearly ready. At the request of the Judge,

Mr. BOUSFIELD stated, in general terms, the nature and object of the experiments—viz., to prove that with a Kern burner under normal conditions, with 2 inches pressure and consuming 3 cubic feet of gas per hour, the maximum illuminating power (about 40 candles) was obtained with a proportion of air of 3 and a fraction to 1—either more or less reducing the light. Another experiment would show a great drop in illuminating power in a Kern burner when the access of oxygen from the external air was cut off. In another one, a Kern burner had been constructed exactly according to the measurements given in the specification, to burn 80 litres of gas per hour, and different shaped cones had been constructed to fit it; and it would be found that a considerable difference in the angle made no appreciable difference in the result. Lastly, he should prove that a burner on the end of a long glass tube, as shown by Mr. Dugald Clerk, would not burn at all with as much air as 6 to 1.

Mr. MOULTON said his experiment would show that the petitioners did not know how to use the Kern burner, because the maximum illumination was not 40 candles but 60 or 70, and that was obtained with a proportion of over 5 to 1 of air. If it were reduced to anything like 3, the light fell off tremendously.

The Court here adjourned for an hour or two to witness the experiments. When the sitting was resumed,

Mr. *Adam* was re-called, and further cross-examined. He produced his notes of the results of the experiments. Roughly speaking, they showed that the burner was at its brightest when the proportion of air was about 4 to 1. He did not think the mantle was quite in the hyper-incandescent zone; and that if it had fitted better, a larger proportion of air would give the best results. In the respondent's experiment, the mantle gave 63 candles with a ratio of 4 to 1 of air—about 23 candles per cubic foot. He had seen better results with a higher proportion of air. He could not agree therefore that about 4 to 1 gave the best results. With a proportion of 6 to 1, it was more difficult to exactly fit the mantle to the hyper-incandescent zone, or better results would be given. It was not essential to the best results that less than the full equivalent of oxygen should be supplied in the mixture, and the remainder obtained from the atmosphere. In another experiment with a large burner, giving a light of 95 candles, the illuminating power fell to 13 when the oxygen was shut off by a surrounding chimney. The alteration was due to a change in the shape of the flame. If a larger chimney had been used, the light would not have been so much affected, if at all. For the best results, the supply of air should have been larger in the first place; it only gave about 18 candles per cubic foot. Witness went on, in answer to questions, to state the results of some of the other experiments, which he said did not agree with his own, which he could not repeat that morning owing to an accident, but would do so next day. The hyper-incandescent zone was very narrow; and the higher the proportion of air, the narrower it became. There was always one place in a bunsen burner which was hotter than any other; but the position of it would vary with the proportion of air. In the ordinary bunsen, the hottest place was outside; in the Kern, it was not at the surface, but just inside. Mantles were generally made slightly larger than the burner. Everybody knew that the mantle should be put in the hottest part of the flame; but it was not known where the hottest part was—viz., close to the green cone. He could not agree that the hottest portion of it was close to the surface.

Re-examined by Mr. MOULTON: The best burner in common use for mantles before the Kern was the Welsbach "C" burner. It had to be employed with a chimney, and gave 16 to 18 candles per cubic foot of gas. He had constructed burners exactly in accordance with Kern's specification. They did not require a chimney; and he had seen a yield of 26 candles. This improvement was due to the construction of the burner, which caused it to take in a larger amount of air; the best proportion being 5·2 to 1—nearly twice as much air as with the old type. He never saw a burner before which consumed so much air. He had prepared a table of the results of the experiments shown by the petitioners the previous afternoon. The highest light in them was given with a proportion of 3·6 to 1 or 4 to 1. The highest yield per cubic foot was about 17 candles. With 5·2 to 1, he had obtained 26 candles. The best yield with a high ratio was better than the best with a low ratio. Kern's object was to have a small flame, and to have the mantle in the hottest part. He gave a method for ascertaining that part which could easily be employed. If one had too large a mantle, it would not fit; by reducing the proportion of air, the flame would expand and fill the mantle, but would not give quite so high a duty as if the mantle and flame were properly adjusted.

A minute discussion of some passages in the specification followed.

Wednesday, July 4.

Mr. *Dugald Clerk* was re-called to state the result of the experiments which had been made, both by the petitioners and the respondents. The

peculiar small blue cone at the base of the flame was characteristic of the Kern burner; and to produce it there must be just the due proportion of air. The more air one injected into a gas-flame, the shorter it became; and ultimately, with the true explosive mixture, one had the minimum flame and the maximum temperature—about 2000° C. In a bunsen flame, there was practically no combustion within the internal blue cone; it was the cool gas and air meeting in non-explosive proportions, ready to light when it got sufficient oxygen. In the Kern flame, this portion was reduced to the smallest possible amount. He had explored the flame with asbestos, and found the hottest part was very close to the little blue cone; and there was another hot part just inside it. In a Kern burner, the lower part of the mantle was more intensely incandescent than near the top. In an ordinary bunsen burner, the luminosity was more evenly distributed. To get the Kern effect, one must have a self-burning flame—not necessarily absolutely self-burning, but the nearer one got to it the better, if the mantle were made to fit the flame. If the mantle were too long or too loose, the maximum effect would not be produced. The lower the pressure, the less air one could introduce. With a pressure of 2·2 inches, he found he could only introduce 4½ volumes of air to 1 of gas; but with 2·5 inches pressure, he could introduce 5¼ volumes. Mixtures varying from 4 to 1 to 14 to 1 would explode in a closed chamber; but beyond these limits they would not. With the lower proportion, the whole of the gas would not be consumed. The best results with the old Welsbach burner were 18 candles per cubic foot; the best he had obtained with the Kern burner was 25·8 candles. The best results the petitioner secured was 40 candles per 3 feet of gas, or only about 13 candles per cubic foot. If the proportions were right to give the Kern flame, the mantle could not have been properly fitted. The proportion of air was 3 to 1; at 4 to 1 they obtained 50 candles. In the respondents' experiments, with a pressure of 2·3 inches, 63 candles were obtained from 2·7 cubic feet, or 23 candles per foot. At York Street, in the evening, with 2·5 inches pressure, he got slightly higher results; the ratio was 5 to 1. By forcing the air through more rapidly, and using more—5·6 to 1—he obtained 29·4 candles per cubic foot. In order to get this, he had to use a smaller mantle. Witness then described an experiment in which a glass cylinder was put over the burner, closed at the bottom so as to prevent access of outside oxygen. He found the light improve. The burner was made according to the specification. He had not experimented at all with what was called the commercial Kern. Water gas, which was largely used now in combination with coal gas, only required 2 volumes of air to consume it; and this lowered the proportion required to produce a self-burning mixture when it was present.

After some little discussion, in which Mr. Bousfield complained that his witnesses had not been present at some of these later experiments, and therefore could not criticize them, it was arranged that they should be repeated at York Street, and all parties should attend.

Further cross-examined: He understood Claim 1 to be for a method of producing a self-burning mixture without the use of an artificial draught. The flame produced was quite different to anything known before. Kern was the first to attempt to burn a self-burning mixture at so large a nozzle as was shown. He did not know the Bandsept burner, but had heard of it. [A Bandsept burner was produced, and lit.] When water gas was used with London gas, it was carburetted; and such gas required as much air to consume it as ordinary gas. It was easy to analyze gas, and find out how much air it required for its complete combustion; but he had not done so. The proportion was a little under 6 to 1.

Mr. Moulton said he had Sir Frederick Bramwell and Mr. Imray present; but as there had been no cross-examination as to the sufficiency of the directions to produce the effects described, he did not propose to call them, and that would be the respondents' case, subject to Mr. Clerk being re-called for further cross-examination as to the experiments.

Mr. Terrell then proceeded to sum up the case for the respondents. He pointed out that there was nothing in the particulars of objection addressed to the questions of the mantle being made exactly to fit the flame; and he then went to the question of a self-burning mixture. The inventor nowhere prescribed any particular proportion of air—in fact, he intimated that the proportion would vary according to the quality of the gas and the pressure—but he said he wanted a self-burning mixture, and told one how to get it. He (the learned Counsel) hoped to show that his theory about this was correct; but even if it were not, but the directions given produced the effect described, any error in the theory would not invalidate the patent. By "self-burning," he meant a mixture which would burn in a closed chamber from which the internal air was excluded; he said so in his specification. He did not mean completely burn.

Justice Buckley asked if Mr. Terrell understood that it was better to have an absolutely self-burning mixture or not.

Mr. Terrell said he took the theory to be an absolutely self-burning mixture, and that, practically, the nearer one got to it the better. For different qualities of gas and different pressures, different proportions were required. The learned Counsel went on to deal with various passages in the specification dealing with the hyper-incandescent zone, and the length and proportions of the cones; and he submitted that the descriptions given were amply sufficient. If there was any mistake in the description of the exact position of the hyper-incandescent zone, it could not deceive anyone acquainted with the subject, and would not affect the patent. He then went on to discuss the claims, and concluded by a detailed criticism of the particulars of objection—especially the statement that "a self-burning mixture is useless and undesirable in incandescent gas lighting."

Justice Buckley remarked that that obviously meant an absolutely self-burning mixture.

Mr. Terrell said the question for the Court was not what was a self-burning mixture, but what was meant by the term in this specification. In any case, the inventor had provided a means for introducing twice the proportion of air to that found in an ordinary bunsen flame; and this was a self-burning mixture in the sense in which he used the words.

Mr. Bousfield then opened the case for the petitioners. There were six claims in the patent; but the real purpose of the petition was to attack Claims 1, 5, and 6—the others being, he understood, absolutely immaterial to either party. The patent was being used to stop the manufacture of the improved De Mare burner. After giving a short history of the previous litigation with regard to the De Mare patent, in which the mantle was held to be an infringement of Welsbach's patent, and of the action to acquire the De Mare patent from the Sunlight Company (as to which an appeal to the House of Lords was still pending), he said there was a striking similarity between the two; the great point in each being the obtaining of greater pressure by the use of two cones. The description in Kern aptly described, in almost identical language, what De Mare discovered. Having quoted the passages from each, the learned Counsel pointed out that the only difference was that De Mare did not expressly mention the fact that the quantity of air was increased, though he spoke of providing a supply of air under pressure, and said this was necessary to complete combustion, and also that it prevented lighting-back. In the actual apparatus, the only difference was one of dimensions; and he should show from decided cases that one could not have a patent for mere directions of that sort. As far as he could see, they only amounted to this—making the bottom cone a little longer and the gas-nib a little smaller. In fact, Kern gave no directions at all about the size of the nib; and De Mare claimed "any form of burner suitable, while retaining the two cones," or ejector. De Mare suggested doing without a chimney long before Kern; and Bandsept also devised a burner for use without a chimney. He did not put this as an anticipation, because it was a different form of burner—having three lower cones—but it prevented Kern saying he invented the notion of doing away with a chimney by increasing the pressure. The learned Counsel then passed on to criticize the theory of Kern as to self-burning mixtures, which he contended was erroneous; and he quoted figures from Professor Smithells's paper to show that even when a larger proportion of air was forced through the flame than the experiments showed could normally occur in a Kern burner, the consumption of the gas was still incomplete. Kern misled them by indicating that one ought to aim at getting a sufficient quantity of air in the mixture to effect complete combustion of the gas; leaving nothing for the oxygen of the air to deal with. Then came a question of fact, as to what was the proportion of air requisite for the complete combustion of London gas. Mr. Dugald Clerk had put the proportion of 6 to 1 as giving the best results from experiments with a long glass tube. But he had not metered the air; and he admitted that his figures were somewhat too high. Mr. Swinburne's experiments would show that a still greater deduction had to be made; and practically it would be found that 4 to 1 gave the best results at ordinary pressures. This was considerably below what he should term an "equivalent" mixture. Another experiment showed the necessity of having a supply of oxygen at the outside of the flame. [This was surrounding a Kern burner with a glass chimney, so as to cut off the external air, when the light was enormously decreased.] This experiment had been criticized by Mr. Adam, who suggested that the diminution was due to an alteration in the shape of the flame; but on repeating the experiment, without the mantle, his Lordship would see that the shape was not visibly altered. If anything, it appeared rather fuller in the upper part; but in the region of the incandescent zone there was no change at all. The same experiment had been made with a much larger chimney; and when the top was left open, the light was not much affected—air coming in down the sides. But when it was covered, all but a small aperture, the same effect as before was produced.

Thursday, July 5.

Mr. *Dugald Clerk* was this morning re-called for further cross-examination with regard to his experiments, which had been repeated the previous evening at the Welsbach Company's premises. After some readings had been taken, it was discovered that there was a leak in the air-supply pipe, which was remedied. The result then was 69 candles with 3·2 feet of gas and 13·2 air; in a second experiment, 12·75 air, or about 4 to 1. There was then a little more air added, which gave a reading of 63 to 64 candles. Then a little more air was added, giving readings of 61 candles, 64 candles, and one at 76 candles, which was found to be due to an error in the photometer. He thought this occurred suddenly. Throughout the experiments afterwards the pentane flame had to be carefully watched. On correcting it, the reading was 70 candles; the mixture being 3·1 gas to 14·5 air. Further air was added, and the candle power fell to 49 (the proportion being 5·39 to 1), and after a few minutes it was 55·5. He agreed there was then too much air. The results obtained at York Street were better than at the Courts, because the pressure was higher. With a rise in gas pressure, the ingress of air increased both absolutely and relatively, and the flame also passed more rapidly through the meshes of the mantle. The statutory minimum pressure in London from sunset to midnight was 10-10ths, and from midnight to sunset 6-10ths. In practice, the pressure was better than that. In his own office, it had varied from 1¾ inches up to 3 inches; and in the Courts he had found it 2·3 and 2·4 inches. In his experiments, the pressure was 2½ inches. He had declined repeating his experiments with a pressure of 1½ inches. The experiments with a brass box under the burner were then discussed; but witness said the results were not satisfactory, owing to the box not being of the right proportions. A light of 65 candles was obtained with a proportion of 5·1 to 1. Another experiment, with the normal supply of air and a gas consumption of 3·1 feet, gave 70 candles. Experiments with a shortened mantle were then given, which gave readings of 76 and 78 candles; the ratio being 5¼ to 1. With the ordinary mantle there would have been a drop. There was no suggestion in the specification that the mantle should be any particular length.

Re-examined: The room was rather crowded; and this to some extent interfered with the success of the experiments. One experiment—with the chimney—which could not be performed in the presence of all the parties owing to an accident, was shown later in the evening, when there were no Counsel present; and the results were the same as he had previously found. He produced the figures as found by Mr. Swinburne and himself, which were fairly concordant. The best illuminating power was obtained with a ratio of between 4·75 and 4·91 of air to 1 of gas; the consumption of gas being 3·1 feet and the pressure 2½ inches. Shortening the mantle simply had the effect of making it fit the flame better. In this way a good fit could easily be obtained. A gas pressure of 2½ inches was not at all abnormal. The Kern burner gave good results with any ordinary pressure; but with high pressures more air could be introduced, and better results attained. He found 5 to 1 about

the best ratio. At 5½ to 1, the candle power dropped; but this was because the flame was smaller, and the mantle was too large.

Mr. Bousfield again cross-examined shortly with reference to the experiments made late the night previously; and witness admitted that Mr. Swinburne's readings did not quite agree with his own. A list of the principal towns in England with the actual pressure at the gas-works showing an average of 16-10ths was handed to witness; and he said he had no reason to disagree with it, though he was surprised to see some so high and some so low.

Mr. Moulton asked leave to put in an analysis showing the actual amount of air required for complete combustion of London gas.

Mr. Bousfield said he might require to make a similar analysis; but it took some time.

Mr. *Horatio Ballantyne* was then called. He said he had carefully conducted the experiment, and found that the proportion was 5½ volumes to 1.

Cross-examined: The proportions varied slightly from time to time. The test was made by measuring the volumes of air and gas, exploding the mixture in a closed chamber, and analyzing the residue to see if there was any excess of oxygen or any unburned gas remaining. The gas used was taken from the consultation-room in the Courts.

Mr. Bousfield then resumed his speech for the petitioners; taking up the point at which he left off—that an absolutely self-burning mixture was not the best, but that the flame should draw some portion of its oxygen from the outside air. This was borne out by the experiments of the previous day, when he was present, as well as by the experiments he should show. The results obtained by the Kern burner were got in this way; the proportion of air being 4 to 1, which was considerably less than that required for complete combustion. On this ground, he submitted that the specification was misleading. The portion of it which was correct was old, being found in De Mare; though it was quite possible that Kern had improved on De Mare's results by slightly varying the size and shape of the cones. The claims they were principally concerned with were Nos. 1, 5, and 6, which dealt with the cones; the other claims, which referred to the form of the tip or jet of the burner, being a separate branch of the subject, and of very little importance, because no one thought of using now the particular form of tip shown in the drawings. The learned Counsel went on to discuss the language of the various claims; submitting that Nos. 1 and 5 were practically the same, though No. 5 might be slightly narrower, introducing certain dimensions and angles. Claim 6 was practically the same again, and would equally prevent the petitioners making and selling De Mare burners with slight alterations in the dimensions, which experience showed to be desirable; and this was contrary to patent law. Mr. Terrell said a mistake of theory, if there were one—which he did not admit—would not vitiate a patent. To some extent that was so; but if the theory formed part of the claim, it did. This was shown by the case of *Mormet v. Beck*, a chemical patent, and by Owen's patent for the manufacture of artificial stone. Passages from this last case were cited; and also from *Patterson v. The Gaslight and Coke Company*, the well-known case relating to gas-purifiers. One or two other cases were cited; and the learned Counsel then concluded his speech.

Mr. *James Swinburne* was the first witness for the petitioners. He said he was familiar with the De Mare specification. It was necessary for the complete combustion of the carbon in gas that a certain quantity of air should be supplied; this was well known before De Mare. He provided means for securing the access of air by two cones united at their summits—what was called a Venturi tube. The best proportions of cones and sizes of the orifices would be arrived at by experience or trial, and would differ with the pressure and composition of the gas, and the mantle used. Kern's burner and De Mare's were the same in principle. Bandsept also had cones similar in character, for the purpose of drawing in a large quantity of air; but he was not familiar with this arrangement. Kern gave exact dimensions for a burner to consume 80 litres of gas per hour. He said nothing about pressure, except that it was to be ordinary. Eighty litres could be passed at 1½ inches pressure, with a proper-sized orifice. The size of the orifice would vary with the pressure. The proportion or design of the Kern burner was, he thought, rather better than De Mare's. High incandescence had been obtained by the use of high pressure. It was the usual practice to use 8 or 9 inches pressure to produce it in the manufacture of mantles. The high pressure produced a larger relative inlet of air; it also caused a more rapid rush past the mantle, and increased the temperature. Kern suggested that the air should be supplied in such proportion as to give the due equivalent of oxygen to consume the whole of the hydrogen and carbon. Mixtures of air and gas would burn in a closed chamber in very variable proportions. He had burned a little over 3 to 1 in a lamp chimney, with the air excluded from the bottom. He took Kern to mean an equivalent mixture by a self-burning mixture, needing no addition of oxygen from the atmosphere. His experience showed that the best results were obtained with a much less than the equivalent proportion of oxygen in the mixture. A commercial Kern burner was here lit, and then covered with a wide glass chimney closed at the bottom, which produced very little effect while the top was left open so that oxygen could get in; but when the top was covered with a cardboard disc, the light was reduced from 95 to 14 candles. The base of the mantle was still fairly luminous. If by the hyper-incandescent zone was meant the small region just near the light blue cone, the mantle was not in it at all. [The chimney was then removed, and the burner again regained its former luminosity.] In his opinion, the conditions for producing the best light, with normal pressure and mantles, were to have less than the equivalent of oxygen in the mixture. With an equivalent mixture, one would have a very small flame, and would require a special mantle. In domestic use, one could only secure a definite pressure by employing a governor; and this would necessarily reduce the pressure to about 1 inch. Practically the burner should be made suitable for varying pressures, of which 1½ inches might be taken as the average. The directions in the specification did not give an equivalent mixture. Witness was then taken through the results obtained in the experiments of petitioners. In most of them the quantity of gas consumed was about 80 litres per hour; and the maximum power was 50 candles with a 4 to 1 ratio. When the air supply was increased, the candle power fell considerably. On gradually decreasing it, the light improved up to a certain point, and then fell again. The experiments were fairly conducted in every way. The respondents' experiments were then gone through in the same manner, as already stated by their witnesses. The later experiments did not, in his view, alter the conclusion that a 4 to 1 proportion gave the maximum results. Kern's specification stated that the angle of the section cone should be between 5° and 7°, and that the action almost ceased beyond 10°. This was not correct, according to his experiments. He had tried angles varying from 5° to 12° and found no appreciable difference.

Cross-examined: The conditions were more favourable at 11 o'clock last night than earlier in the evening. In those experiments, the maximum effect was produced with ratios of 4·75 and 4·91 to 1. In some of the experiments, the yield was 22 candles per cubic foot. In others, they only got 40 candles for 3 cubic feet, instead of nearly 70. The Welsbach people, from their long experience, might be better able to fit the mantle to the burner. There were often discrepancies in results, even by the same observer. Two mantles out of the same batch would frequently give different readings. An absence of fit in the mantle was the most likely cause of bad results. If a mantle were too large, a smaller proportion of air would improve the result by increasing the size of the flame. His idea was that in the course of this case the respondents had discovered the advantage of slightly shortening the mantles.

Friday, July 6.

Mr. *Swinburne*, further cross-examined by Mr. Moulton, said he did not agree that the Kern mantle was in the hottest part of the flame, which was close to the whitish zone. The shape of the double cone in the commercial Kern burners, which were largely used for outdoor lighting, was different to anything shown in De Mare's drawings. He did not know of a burner without a chimney being used before Kern's.

Re-examined: The Bandsept burner gave similar results to Kern's, and substantially in the same way. It produced a very high degree of aeration. [An experiment was then shown to prove that the ratio of air to gas increased with an increase of pressure in a burner made according to De Mare's patent.] There was no difference in principle between the De Mare and Kern burners; but in the latter, the cones were better proportioned. Referring to the experiments at York Street at 11 o'clock at night, he said they were taken rather at random, and there was nothing in them to lead him to alter the conclusions he drew from the previous experiments. Taking any given burner, a higher pressure gave more aeration and better results; but a smaller mantle was required. Closeness of texture was also important. The Kern mantles were very open. He believed the principal reason why the petitioners' experiments showed lower results than those of the respondents was that they worked with a lower pressure. There might be a difference in the mantle, but he did not think so. The lower average did not in any way vitiate the experiments.

Professor *Vivian B. Lewes* was next called. After stating his qualifications and experience, he said the models of the De Mare burner were made at his request, exactly in accordance with the specification—one small and one large, in order to take the sized mantles which were available for experimenting with. The Kern models were also made carefully from the specification. He had used the same mantle in testing the two burners. The large Kern burner gave a light of 14·4 candles per cubic foot; and the large De Mare 15 candles. The small burners gave practically the same result. The principle of the De Mare patent was the same as the Kern; the only difference was in the proportions of the cones. Witness then described in detail the appearance of the flame in an ordinary bunsen burner, and in De Mare's and Kern's. In Kern's specification, the essence of the patent was to get an equivalent mixture of gas and air in a burner for incandescent lighting, without using abnormal pressure. The result of experiments showed that an equivalent mixture of London gas would require from 5·5 to 6·3 of air to 1 of gas; the variation being due to the way in which the gas was made and the proportion of carburetted water gas contained in it. A burner made according to the dimensions given in Kern's specification, to pass 80 litres of gas per hour, did not give anything like an equivalent mixture. It was very difficult to ascertain the exact proportion it did take; but the best results were obtained with a proportion of from 3·7 to 4 of air to 1 of gas, according to the pressure. By increasing the proportion of air, the candle power at once tumbled down, either with the model Kern or the commercial Kern, working at normal pressures. Witness produced a chart showing the results of a number of experiments he had conducted himself, in which the maximum light was obtained with a proportion of air of 3·65 to 1. With either an increase or diminution of air, the light fell. He had tried suction cones of different angles—5°, 7°, and 12°, which was the largest angle he could get without altering the proportions of the burner; and he found they all gave similar results, both as to the suction and the light produced. The hyper-incandescent zone was simply the phenomenon of a bunsen burner concentrated in a very small space, where the temperature was very high; but it was so small and so low down, that it could not properly heat the mantle. There was hardly a Kern burner in the market which could not be improved by cutting off some of the air supply. There were two extremely hot portions in a bunsen flame—one corresponding to the Kern hyper-incandescent zone, and the other where the flame completed its combustion with the oxygen of the air; and it was the combination of these two, as nearly as possible on the surface of the mantle, which was the secret of successful incandescent lighting. With regard to pressure in London, one might get 2 inches or more near a main; but the average pressure over London would not exceed 1½ inches. Burner makers always worked to 1 inch pressure, because it could be always relied on. Witness produced a Bandsept burner which he had had since 1896. It was well known to people connected with gas lighting before 1897. At the 1897 meeting of the Gas Institute, at Bath, it was exhibited in large clusters. It was a chimneyless burner, and was also made to use with a chimney. It was employed by the Paris Welsbach Company. No doubt it had undergone modifications and improvements since 1896. The specimen he produced gave a very high degree of aeration. He had several De Mare burners, and recognized one produced as that which the De Mare people used. It gave a magnificent aeration, and produced a batswing flame which could be turned down without

firing-back. The experiment with the wide cylinder surrounding the flame, fairly indicated the effect of depriving it of external oxygen.

Cross-examined: In 1897 he was giving attention to the question of burners for incandescent mantles. At that time, ordinary gas took from 5·5 to 6·2 volumes of air for complete combustion. He made hundreds of experiments. He also tested the effect of aeration on the combustion of gases; and in 1897, he came to the conclusion (as stated in the "JOURNAL OF GAS LIGHTING") that more aeration was required to get a good light, especially if one wanted to do without a chimney. The ordinary bunsen burner would have 1 to 2·2 or 2·4. Increasing the aeration improved the effect. The Kern burner increased the aeration, and would therefore give a better incandescence than the ordinary bunsen, if stopped at the right point. As a general rule they over-aerated. In 1897, the bunsen gave 16 to 18 candles with a Welsbach burner. In one of his experiments in this case, the model Kern burner gave about 12 candles. He did not admit that this was a bad experiment. He did not doubt he should have got a better result with the same mantle on a "C" burner. The best mantle for one flame was not the best for another. Witness was then cross-examined in detail on the results of some of the experiments, none of which, in his opinion, were worth very much, on account of the differences in mantles and other conditions. He considered the experiments at York Street when all the parties were present were a farce. Those made later, when only four persons were there (of whom he was not one), were performed under better conditions; but the pressure employed—2½ inches—was abnormal. In 1897 he mentioned 18 candles per cubic foot at 2½ inches pressure as a very good result. In one of the experiments at York Street, over 22 candles were obtained. No doubt, it was a very good mantle. In that case, there was pretty complete aeration; and the result might have been improved by cutting off some of the air. He could not say for certain, because he did not see the experiment. There was nothing to prevent 4·8 air to 1 being a good proportion of aeration, provided there was sufficient pressure. One-tenth of an inch pressure would sometimes make a considerable difference. With regard to one of the results, his opinion was that there must have been something wrong with the conditions. On its being suggested that the intellect of man was capable of adjusting the mantle to fit the flame, witness said he did not know it was allowable to use intellect in patent matters; one was bound by the specification and the drawings. The high reading might have been caused by a variation in the standard. He had many charts of results in his own laboratory, similar to the one he had put in; and the results were fairly concordant. They were made with gas at the ordinary pressure. He knew of no burner before Kern's having the same amount of aeration, which did not employ gauze. A passage from an article in the "JOURNAL OF GAS LIGHTING," with regard to the necessary conditions for success in incandescent lighting, being read, witness said that was exactly what he had been trying to say all the morning. It would be better if one could get the whole mantle to the same temperature; but in practice the first ¾ inch gave 60 per cent. of the light—not the first $\frac{3}{16}$ inch. With regard to the Bandsept burner, it was in 1896 known to him as a chimneyless one. The first patent was in 1895. The 1896 patent referred to a chimney; but this was a subsequent modification. He made Mr. Bandsept's acquaintance in 1893.

Re-examined: The Bandsept burner he put in had no provision for a chimney. A self-burning mixture was produced, as was shown by the fact that he made a burner to burn under water. It was not enough to make the mantle fit the head. It must fit the flame also; and this was the most important point. Bandsept used gauze after having tried a perforated metallic thimble similar to Kern's. With regard to the last experiments at Palmer Street, at 11 o'clock at night, witness had no idea they were going to be made. He was satisfied that the results he had obtained in his own experiments, as indicated on the chart, were correct; and they were concordant with what had been shown his Lordship. He could not criticize the experiments which he did not see. There were many points which might affect them—in particular the pentane used in the photometer. With regard to the former experiments, he did not think they were worth the paper they were written on.

Mr. *Swinburne* was here re-called, and stated that he had tried a further experiment with the long glass tube employed by Mr. Dugald Clerk, and found that Mr. Clerk's figures were 40 per cent. wrong. By the method he employed, the reading would be 100 when it ought to be 60. He (witness) employed ammonium chloride.

Mr. MOULTON said Mr. Clerk tried ammonium chloride, but found it so unsatisfactory that he abandoned it.

This concluded the petitioners' evidence.

Mr. NEILL then proceeded to sum up the case. He commenced with a short history of previous attempts in the same direction—such as the limelight, the Clamond, Fahnehjelm, &c., coming down to Welsbach's invention of the mantle. All these things were well known to De Mare. The problem he sought to solve was getting a larger admixture of air, passing with a sufficient velocity to prevent firing-back. He read and commented on certain passages in De Mare's specification to bear out this contention. With regard to Kern, the case as opened was that Kern meant what he said—that the chemical equivalents necessary to complete combustion, or 6 of air to 1 of London gas, were to be obtained as nearly as possible. This could be obtained with an ordinary bunsen burner; but it could not be burnt, because it would fire-back. Mr. Dugald Clerk's evidence in the first place was that a 6 to 1 mixture was actually used in the Kern burner; but this was afterwards shown to be an entire mistake. Then the respondents turned round and said that Kern did not mean an "equivalent" mixture at all, but anything over 4 to 1. The experiments clearly showed that the best results were obtained when the combustion was perfected at the surface of the flame; and therefore the patent was bad, because the claim was really for an "equivalent" mixture. Even if he were right in this, the patent would be bad, because it was merely an improvement of De Mare. On this point, Counsel cited the case of *Nichol v. Swears and Wells*, a patent for a riding habit. According to the construction now sought to be put on Kern's patent, the making of De Mare's burners would be an infringement. He then reviewed the experiments that had been made, which showed that the best results were obtained with a proportion of about 4 to 1, employing the normal pressure. No doubt, higher results were realized with a larger proportion of air at greater pressures; but that was common knowledge. The patent was intended to be used with gas at the normal pressure. In conclusion, he submitted that the petitioners had made out their case.

Mr. MOULTON, on rising to reply, was reminded by his Lordship that the two points made against him were anticipation and a misleading specification. Mr. Moulton said the only anticipation relied on was De Mare's specification. There was no suggestion that it had been used in practice. The question as to the specification consisted of two allegations—one that a self-burning mixture was not used for incandescent lighting, and the other that such a mixture could not be obtained by the means shown. "Self-burning" in the objection, of course, meant what had been called absolutely self-burning. No evidence had been given on the plea of non-utility; but this only applied to the claims which had not been practically dealt with. He then gave a description of the bunsen burner, the quantity of air it consumed, and the defects attending its use.

Saturday, July 7.

Mr. MOULTON, resuming his speech, said the utility of the Kern burner was shown by its extensive employment; while the De Mare had practically never been used.

Justice BUCKLEY said it was suggested that the use of the De Mare burner had been prevented by the injunction against the employment of the mantle.

Mr. MOULTON said the Sunlight Company purchased the De Mare patent, and could have used it with their own mantle, which was held not to infringe. Kern showed how to make a burner without a gauze top, such as was necessary with Bandsept's, and which was very inconvenient. The three points achieved by Kern were the improved light, absence of chimney, and absence of gauze at the tip. As a rule, when a man had really made a great practical advance, his patent was valid; though, of course, it was possible that the specification might be drawn so as to be open to attack. The main lesson of the patent was that one wanted higher aeration and a smaller flame, concentrated so as to give a higher temperature. He admitted that Kern and Professor Lewes were totally at variance; but Kern's accuracy was shown by the practical success which attended the following out of his directions. The central question was this: Was Kern right in saying that perfection in incandescent lighting was approached, as one approached complete or equivalent aeration?

Justice BUCKLEY said the condition of ordinary pressures must also be introduced, by which he meant from 1 inch to 2 inches or at rifle over, but not above 2½ inches.

Mr. MOULTON said he did not think the introduction of this qualification affected his proposition. He then went on to discuss the importance of the mantle fitting the flame; pointing out that such fitting was necessary with any burner, and interposed no difficulty. The real problem was to get a very hot flame—one could easily adapt the mantle to it. He entirely joined issue with Professor Lewes when he said that the Kern burner would be improved by diminishing the air supply. Discussing the question of what was meant by a self-burning mixture, he thought 5·5 to 1 was a really equivalent mixture; and what the patentee meant was that the nearer one got to this the better. Criticizing the experiments of the petitioners, the learned Counsel suggested that there was one consideration which deprived them of all possible weight—viz., the results obtained being all far below those usually found, it was evident that the conditions were not properly observed; and therefore not only the positive, but the comparative results were not to be relied on. He asked his Lordship to be guided by the experiments performed at 11 o'clock at night in the presence of Mr. Swinburne, when a light of 22 candles per cubic foot was obtained; the pressure being 2½ inches, and the proportion of air 4·8 to 1. He was perfectly willing that Mr. Dugald Clerk and Mr. Swinburne should be asked to conduct any series of experiments his Lordship might suggest, and abide by the result; although he submitted that the evidence already given was sufficient.

Mr. BOUSFIELD said the proportion of air in the experiment referred to was, according to his calculation, less than 4 8.

Mr. MOULTON proceeded to discuss some of the other experiments.

Justice BUCKLEY said the whole evidence seemed to be that the proportion of air which yielded the best result varied from 3·75 to 4·8—nothing like 5·5, the theoretical equivalent.

Mr. MOULTON then went to the specification, which he analyzed and paraphrazed at considerable length. He contended that De Mare only gave a general suggestion, which proved quite barren of useful results; but Kern gave directions which no one could go wrong about. There was nothing which could mislead anyone. He did not think it was material that the patentee was absolutely right in his theory of a self-burning mixture, though he thought he was. Even if he were mistaken to a slight extent in his theory, that would not affect the validity of his patent, when he had properly described the means to attain the results he had described. Incidentally, he reverted to the question of a self-burning mixture, and submitted that such a mixture did not imply that there should be no residue left after combustion, either of carbon or oxygen, but that combustion should go on freely without the aid of external air. It was possible that Kern had over-estimated the effect he produced, especially under English conditions; but still the result he described was achieved, and no one could be misled by the theoretical error.

Monday, July 9.

Mr. MOULTON this morning resumed his reply on behalf of the respondents, and dealt first with the question of pressure, saying he had only realized on Saturday that his Lordship drew any distinction between the effect of aeration at pressures below 2 inches and above it. The pressures Mr. Clerk had employed were simply those obtained in his own laboratory. There had been no attempt to obtain good results by employing high pressures. Since Saturday, experiments had been repeated which showed that the effect of complete aeration was the same whatever the pressure, from 1·3 to 2·5 inches; and he therefore reiterated the suggestion he had previously made that his Lordship should direct further experiments to be made.

Justice BUCKLEY said Mr. Moulton had better deal with the case on the evidence as it stood. He thought that there had been quite enough experiments.

Mr. MOULTON considered there was no evidence to show that the lower

pressures affected the result. He proceeded to cite passages from the evidence of Professor Lewes, and contended that they were useless because the same mantle was used for different degrees of aeration, whereas the mantle best suited to each particular mixture should have been employed. The only experiments in which the full power of the burner and mant'e had been produced were those of the respondents. The petitioners all through admitted that Kern's burners gave an improved result, and yet in none of their experiments had they reached the result obtained by an ordinary burner. His submission was, on the evidence that provided the mantle properly fitted the flame, the higher the aeration the better the illuminating power, whatever pressure was employed. In reply to his Lordship, he admitted that one of the experiments showed that in the Kern burner there was not complete aeration, and that the oxygen of the surrounding air played a part in the combustion. But he could not admit that the experiment was of any value quantitatively. He contended that the meaning of the term "self-burning" in the specification was freely self-burning—not absolutely self-burning. He then discussed claims Nos. 1, 5, and 6, and the alleged anticipation by De Mare, which, he contended, was a totally different thing; the air being admitted in a different place, and the evidence showing that De Mare only aimed at a mixture similar to that in an ordinary bunsen. The De Mare patent was published in 1894; and nothing was made of it until Kern's came out in 1897. In some cases, as in the present, the right dimensions and proportions meant all the difference between success and failure. The last question he would deal with was one of law—viz., whether the patent was invalid, because he had claimed a self-burning mixture, which, in the absolute sense, was not at any rate under all circumstances attained. His submission was that a patent would be supported if the directions were sufficiently full to produce the effect described, even though the patentee might be mistaken in his theory of the exact physical causes which conduced to the effect. He maintained that the cases cited on this point by his learned friend had really no application.

Mr. Bousfield added a few comments on two of the cases referred to, to which Mr. Moulton replied.

His Lordship said he would give judgment in a few days.

THE DUBLIN STEAM-ROLLER CASE.

Text of the Judgment of the Irish Court of Appeal.

In the "Journal" for the 26th ult. (p. 1733), we briefly noticed the result of the appeal by the County Council of Dublin against a judgment of the Master of the Rolls, restraining them from using, or causing to be used, a steam-roller to the detriment of the mains or pipes of the Alliance and Dublin Consumers' Gas Company. In view of the importance of the judgment of the Court (composed of Lords Justices Fitzgibbon, Holmes, and Walker) which was commented upon in our editorial columns last week, we give the full text of it to-day.

Lord Justice Fitzgibbon, by whom the judgment of the Court was delivered, said: It is remarkable how similar this case is to the St. Mary Abbott's case, not merely in the question which we have to decide here, but in the evidence by which a right is sought to be supported, and also by the course which the case took in the Court in the first instance, and also in the Court of Appeal. The question of right first and of proved liability secondly, and the question of costs in the third place, must be separately considered; and, taking them in that order, it appears to us that each of the questions is reasonably clear. There is one of them with which I have had some little difficulty; but it is not a question of principle and evidence. Now, as regards the principle, the road authority unquestionably has a right to maintain the roads under its charge by all reasonable means, having regard to what reasonable means are at the time at which they are doing the work. It would be a monstrous thing to say that the road authority was not to advance with the times in the mechanical and economical methods of dealing with the discharge of their duties. They are entitled to advance with the times; and they have duties to discharge towards other people in so advancing. You might just us well contend that the road authority now was discharging its duty by keeping the roads in a proper state for the passing of the sledges of our forefathers, as to say that they are not bound to provide for the increasing and altered traffic which the roads have now compared with what they were obliged to carry when they were made. On the other hand, the Gas Company, and, indeed, all persons who have rights over those roads concurring with the rights of the road authority, are entitled to protection in the enjoyment of what they have got, provided they have got it properly, lawfully, and reasonably at the time they were originally acquired. And where such work is done as that of laying gas-mains, which is work that at the time it is executed is reasonably expected and intended to last for a considerable number of years, it is bound to be done properly and with reasonable skill and reasonable care and expense at the time it is done, for the purpose of meeting and overcoming the difficulties that may be thrown on it by the user of the place in which it is laid at the time the works are carried out. And if changes do take place which it is for the advantage of other parties to adopt, they can only adopt them with due regard to the rights already acquired in the subject matter over which their powers extend—by people like the Gas Company in the present case. In regard to this Company's rights, what is the evidence? The present case upon the main issue really divides itself into two parts—first, as to the affirmative pieces of evidence to sustain the action brought by the Gas Company, were any of the pipes (and I do not trouble about the differences between mains and service-pipes at present), were any of the pipes belonging to the Gas Company broken by the steam-roller; and, secondly, if they were, was that breaking due to the fact that they had not been properly laid, because the duty of properly laying was a duty that fell on the Gas Company when they laid the pipes, with the modification, and with the condition, which I have had regard to, that the measure of propriety was the measure of the circumstances of the time. In this case, the case is that five pipes were broken. One of these pipes was broken under circumstances merely special and exceptional, and which were undoubtedly such as to make the road authority responsible. Money was paid, and liability admitted; and it is out of the case entirely. I do not think it can be relied on, as it seems to have been by either side, though each side seems to have made some capital out of it when it was before the Court below. The second of these cases was one in which the Master of the Rolls found, and apparently on sufficient evidence, that the immediate cause of the mischief which was done was the way in which the pipe itself had been laid, because, as I understand, it was a vertical structure of a metal character put on the road to reach the pipe below, and it was driven in like a nail or a spike driven into wood—it was driven into the pipe at the bottom by the passing of the steam-roller. The Master of the Rolls was satisfied that they had not based it on a sufficiently solid foundation, and that they allowed it to project, and anything passing over it was liable to do injury. That is out of the case on the plea that the pipe was not properly laid, or rather that the thing that damaged the pipe was not properly laid. That leaves three injuries still—one an injury to a main, and the other two injuries to service-pipes. The injury to the main occurred at a very exceptional place, because it was where the main was crossing over a bridge, and where there was no substratum for it except the masonry or the substance of the bridge itself—a place where cover of any depth would be impossible, and where the thing immediately under the pipe was so rigid as to make a fracture more easy, and where the pipe was not level. Therefore, it was a place in which every condition tended towards making it easy to injure the pipe by the passing of a great weight over it. Mr. O'Shaughnessy, in opening the case, with his usual emphasis, said his case was that they did not do it at all; that it occurred, if at all, some time shortly before, I think, the 24th of June, on which it was detected; that it was not caused by the roller, for which he sought to prove an *alibi*, going back to the 3rd or 4th of June previously.

Mr. Pim: October.

Lord Justice Fitzgibbon: October. Upon that it is a mere question of evidence. I think all the probabilities are in favour of its having been broken by abnormal pressure; and the roller having been in the place, it was not unreasonable to suppose that it was broken by the roller. In no view of the case could the breaking of the pipe, situated as it was, be justified by the use of a steam-roller, unless we can go to the full extent, which we are not going to do, of the law which Mr. Collen tried to make out—that gas-pipes were to exist only at their peril on the roads under his control. A very exceptional thing would make it necessary to bring the steam-roller there at all; and if it could not be brought without breaking the pipe, it should not be brought there; and if it could be steered over the bridge without breaking the pipe, there would be no cause of action. That is the case in which it appears to me that the defence of the County Council fails. There is evidence they did the mischief—that the pipe was properly laid originally, having regard to the circumstances of the case; and therefore it gave a cause of action. Before considering whether it gave a cause of action sufficient for an injunction, we should consider what the other cases are. The two other cases are cases in which it was not the main that was injured but a service-pipe at right angles, as far as the roller is concerned, to the position of the main. These were pipes coming out of the top of the main. They are then necessarily at a higher level than the main from which they are taken. They have to cross the road transversely, and are nearer the surface. They are smaller in diameter, and they have to cross over to wherever the gas is wanted. In one of the cases, the service-pipe was not supplying gas to the house. That was the Overton case. But it was in connection with the main; and therefore damage to it would damage the main, and lead to an escape of gas. The other one appears to have been in actual use. It only requires to see them to see that each has been subjected to pressure by something with a flat surface like a roller; and I also say, from the length of the pipe, and its being perfectly straight before you come to the bend, that it was something like a steam-roller. I have no doubt that these two pipes were, one pulled out and the other practically broken by the steam-roller. There is no question at all that at the sides of the road they were improperly laid for any purposes of resisting pressure. But where they were crushed there is no evidence to lead to the conclusion that they were not well enough laid to survive a long number of years; and I think there is no possibility of doubt that there is affirmative evidence that they were injured by the steam-roller. Nor is there sufficient evidence to sustain contributory negligence by being improperly laid. We think these are three cases in each of which, *primâ facie*, there is a cause of action. Then we come to the question, Is that a foundation for an injunction? In the St. Mary Abbott's case, a single instance was held to be sufficient to maintain an injunction as distinguished from damage. The question whether such an instance, or such instances, or any number of instances, is sufficient, depends on the question whether it proves that there is a likelihood of further damage. An injunction is a precautionary measure, resting on jurisdiction, to prevent future injury. I do not think it is possible reasonably to doubt that all pipes similarly situated to this main and these service-pipes would be likely to be injured by similar use of the steam-roller; and therefore the question is whether the circumstances in which they were found were of such general application as to justify so general a remedy. The question is a very definite one, and has been fully argued. It was raised in a different form. It really was whether the protection of an injunction should be given to pipes of the Gas Company that had been laid before steam-rollers were thought of—properly laid as regards the circumstances of the time, but laid under circumstances that now made it impossible to use steam-rollers without the likelihood of doing damage. On that issue our opinion, supported and sustained by the St. Mary Abbott's case, and by the judgment of the Master of the Rolls, in which I concur, must be against the defendants. They had the duty I have already defined, before they introduced any novel mode of repairing the road, to have regard to, and to respect liability to, injury of pipes which existed previously, and which were laid without reasonable anticipation that the great strain would be put on them which the new instruments introduced. For these reasons, the injunction must, I think, be sustained which was obtained in the Court below. I wish to be extremely emphatic as regards what it will not give the Gas Company. The use of the steam-roller is expressly recognized as a thing which this County Council is entitled to avail itself of. Without Acts of Parliament at all, the evidence of experts and engineers would always be admissible to show what, at a particular time, was reasonable or ordinarily accepted as a means of repairing the road. At present, having regard to Acts of

Parliament, and to what we see going on every day, roads must be made and may be repaired, if they are done economically, by means of steam-rollers; and the Gas Company must be aware, as far as my opinion can go, in the clearest language, that in everything they do now, and have done for some time past, with reference to laying gas-pipes or dealing with gas-pipes, they must do that with the knowledge, and with the consequence of knowing, that the roads are roads that are likely to be repaired, and that those who have charge of them have the right to repair them with steam-rollers, and no matter what depth they have to go they will have to go to a depth reasonably sufficient to protect the pipes from a means which is a right, economical, and lawful one—namely, that of using a machine by means of which surfaces are put on the roads more permanent, useful, and beneficial to the majority of the community than the old and less perfect methods that went before. In the St. Mary Abbott's case there was nothing contradictory to that in the judgment. When defining the duty to lay the pipes properly, the Court said, if required, they would put into the order that the protection extended to "properly laid." The words "ordinary traffic" were used; and they were used by the Court, not merely to mean passing over the road, but reasonable use of the road by those who had charge in the way of repairing or maintaining it. We wish to make the injunction more specific than the Court did; and we make it—"An injunction against using any steam-roller on any road under which the gas pipes of the plaintiffs have been laid so as to break or injure any pipes then properly laid under such road, regard being had to what at the time of the laying of such pipes were the then ordinary traffic and the then reasonable means of repairing and maintaining the road." The now reasonable means include steam-rollers of reasonable and proper weight; and the Gas Company will understand what the extent of their immunity is. That reduces it to a question of costs. The costs in the Court below must follow the finding, because the liability was established and a decree obtained; and the question whether the costs of the appeal are to follow the costs of the Court below must depend on whether the modification that we are making in the language of the injunction is a modification of the real substance of what the parties at the time ought to have understood to be the true meaning of the injunction, which we are only making more specific and explaining. When we read the judgment of the Master of the Rolls, it is plain that he was speaking only of pipes properly laid, and that the definition of pipes properly laid was not really in controversy before him as being a thing that it was important should be defined by his order. The opening of the appeal was the opening of an appeal on the lines of getting the suit dismissed altogether—first, on the ground, in which they have failed, chiefly put forward by Mr. O'Shaughnessy, that the main in question was not broken by the steam-roller, and that the service-pipes were broken because they were not properly laid, having regard to the ordinary traffic. Mr. Healy pressed the legal point that there was a kind of immunity, such as a railway company possesses with regard to using a steam-engine without negligence, in every case in which they used the steam-roller without negligence; and that there was no negligence towards these pipes. In all these pipes we are against him; and we are not making variations in principle or fact in what ought to have been understood from the Master of the Rolls's order and what he intended. The test as to whether the costs of the appeal should follow the costs of the Court below is this, Would the appeal have been brought if the modification had been made below? If the modification had been made below, and the injunction given by the Master of the Rolls in the very words of ours, every word of Mr. O'Shaughnessy's and of Mr. Healy's arguments would have been equally addressed to us to show that the order was wrong. On this test, the costs of the appeal are really a necessary part of what the County Council must bear; and accordingly we modify the injunction by amending its terms, as I have read. But we must in other respects affirm the order, and direct the appellants to pay the costs of the appeal. And from henceforth the Gas Company had better abandon the heroic style they adopted in their correspondence, which was as monstrous an assertion of autocratic right to control and use these roads, as was, on the other hand, Mr. Collen's decision that no matter what might happen to the gas-pipes he could run the steam-roller anywhere he pleased. I hope the result of this case will be to show that the County of Dublin is not to lag behind any other place through having its roads constructed on mediæval principles. And I hope that the Gas Company will be protected in the enjoyment of the profits they derive from pipes when they are old ones; but when they come to put down new ones, they will have to lay them better than the old ones, and they will have to march with the times.

A Question of Employers' Liability.

At the Stockport County Court on the 29th ult., before his Honour Judge Yate-Lee, sitting as Arbitrator, Michael Moran, employed as a labourer at the Stockport Gas-Works, made a claim against the Stockport Corporation, under the Workmen's Compensation Act, 1897, for 13s. 6d. per week, for injuries sustained while following his employment. Mr. A. Briggs appeared for Moran; the Town Clerk (Mr. R. Hyde) represented the Corporation. The applicant's case was that on Dec. 25 he was engaged in changing the purifiers, when the gas ignited, and he was so seriously burned that he had to be taken to the Infirmary. He had been totally incapacitated for work, and had received from the Corporation 15s. a week since the accident. His average weekly earnings during the preceding twelve months had been 27s. a week. None of the material facts were disputed; the case for the Corporation resting upon the question whether or not Moran was guilty of "serious and wilful misconduct." The Gas Engineer (Mr. S. Meunier) was called, and stated that, in his opinion, the fire which caused Moran's injuries resulted from the use by him of a lighted lamp in the purifier-house, and the opening of a wrong valve. Two other witnesses gave evidence to the effect that Moran's attention had been drawn to the danger of using the lamp when changing purifiers; while others stated that he had confessed to turning the wrong valve. It was mentioned that he was in the habit of carrying a lamp to start the engine and for other purposes. His Honour came to the conclusion that Moran's acts did not amount to "misconduct" within the meaning of the Act, and that the accident did not arise through anything he had "wilfully" done. His application must therefore succeed; and as his wages were 25s. a week, he must have 12s. 6d. weekly during the period of his incapacity. His Honour also allowed special costs to the amount of £5 beyond the ordinary costs. The Town Clerk applied that, as the Corporation had paid Moran 15s. per week since the accident, which was 2s. 6d. per week more than the judgment to which his Honour held he was entitled, the over-payment should be considered and dealt with. His Honour said he would consider the point, but he thought to take the advantage would be hard upon Moran, who, thinking the 15s. was the amount to which he was entitled, and which the Corporation had so willingly paid, had no doubt spent it all. The Town Clerk, while pressing for it, said he did not think the Gas Committee would be hard with Moran. They might not see fit to deduct it.

Action in Regard to a Coke Contract.

At the Cambridge County Court, on the 27th ult., his Honour Judge Bagshawe, Q.C., and a Jury had before them an action brought by the Cambridge University and Town Gas Company against Messrs. Illsley and Son, coal merchants, for the recovery of £8 18s. 4d., damages for breaking a coke contract. The Company alleged that defendants bought 400 tons of coke from them, which they undertook to remove within a stipulated time, and that they failed to do so. Defendants counterclaimed £9 15s., alleging that the plaintiffs had not fulfilled their contract. Mr. Rayson appeared for the Company; Dr. Cooper represented defendants. Mr. Rayson, in opening the case, said the defendants entered into a contract on the 25th of January to purchase 400 tons of coke, at 14s. 3d. per ton. Defendants did not collect the whole of the 400 tons, and asked for further time; and the Company extended it from March 10 to March 25. On the 23rd, the plaintiffs gave defendants notice that, as they had not collected the 400 tons by that date, they would be charged the market price for the rest. Coke at that period was rapidly rising in value. The defendants counterclaimed £9 15s.; alleging that 65 tons were not delivered, whereas they had 350 tons. There was, in fact, a balance due to them of only 45 tons 5 cwt. Mr. R. Brown, Manager of the Company, said defendants ought to have cleared 10½ tons a day, excluding Sunday. From the date of the contract to Feb. 28, they cleared 207½ instead of 300 tons. The practice in the trade was for purchasers to take delivery daily, and in about equal quantities. The coke had to be carted away every day to prevent inconvenience. In cross-examination, witness admitted that there was no clause in any of the other contracts as to the quantity which should be cleared daily; it being, he said, an understood thing. Mr. J. H. Troughton, of Newmarket, said if the coke was not taken away within the given time it was the custom to regard the contract as broken, and not to supply the purchaser. It was generally understood that the coke was to be taken in regular daily or weekly quantities. Mr. Brooks, one of the Company's clerks, produced books showing that defendants cleared 335 tons 3 cwt. up to March 31. Defendants' carts were sent away partially empty on six different occasions between March 13 and 24, because there was not sufficient coke for them. If they had come early in the morning, when the other merchants did, they would have had their share. Sometimes they came after two o'clock, and once at four. He told them that if they wanted to be sure of their coke they must send by 7 a.m. His Honour said he should be glad if Counsel on both sides would say what they wanted to ask the Jury. At present he thought there was very little to go before them. Mr. Rayson said he wished to submit the question of the unreasonableness of the hour. He contended that the defendants were guilty of breach of custom or implied contract as to days and times of days when they should send for the coke; and therefore he asked for damages. Dr. Cooper urged that plaintiffs were guilty of breach of contract in failing to supply the 65 tons of coke contracted for when it was sent for at reasonable times. In his opinion, there was no custom binding them to take a particular quantity daily; and this being so, he asked for damages. Evidence having being called on behalf of the defendants, his Honour, in summing up, pointed out to the Jury that there was nothing in the contract about delivery per diem. As to the question of custom, was there proof that anybody entering into a written contract must be taken to know of the custom; and, if so, what damages did they find the plaintiffs had been exposed to by the defendants failing to take away their 10½ tons of coke per day? With regard to the counterclaim, the delivery was short by 65 tons. If the evidence of the witnesses that vans were sent for the coke was believed, the defendants were entitled to the difference between the contract price of these 65 tons and the market price at the time of the breach of the contract. The Jury returned a verdict for the plaintiffs on the claim and for the defendants on the counter-claim. His Honour gave judgment accordingly, and allowed the defendants the costs of the action.

Claim for the Supply of Electric Current.

At the Northampton County Court, a few days since, before his Honour Judge Snagge, the Northampton Electric Light and Power Company, Limited, sued Mr. George Smith Whiting for £6 17s. 6d., made up as follows: Electric current supplied from Michaelmas to Christmas, 1899, £5 4s. 8d.; rent of meter, 4s.; use of installation, £1 4s. 10d.; and quarter's rent of meter from Christmas to Lady-day, 4s. Mr. Wells, who appeared for the Company, said he understood the defendant disputed the charge, as he contended that he had not consumed so many units. Defendant said his case was that there had been great misrepresentation, which he desired to prove; and he went into figures comparing his gas and electric light bills. Mr. Wells said another grievance on the part of the defendant was that, when he had the installation put into his house and shop, it was done by the National Free Wiring Company; and he seemed to have been told that the cost of the electric light would not be more than gas. The Manager of the Wiring Company, however, had nothing whatever to do with the Electric Light Company. After hearing the evidence and defendant's statement, his Honour said there was really no defence to the action. The meter was admitted to be all right, and the contracts were before him. Mr. Wells said the defendant had been offered to have his meter tested in London; but he would not do so. His Honour said the only defence was that the defendant had to pay more than he expected. When first installed, the electric light was often dealt with as a toy; it was turned on and switched off frequently, which meant expense. After the light had been used for some time,

people became more careful. Defendant said he had done his best to economize the current. His Honour gave judgment for the plaintiffs, and ordered payment in a month.

Embezzlement by a Gas Collector.

At Todmorden last Thursday, Eli Crowther, aged 40, for several years collector to the Hebden Bridge and Mytholmroyd Gas Board, was committed to the assizes, charged with embezzlement and falsification of accounts.

The Quality of the South Metroplitan Company's Gas.

At the Southwark Police Court last Tuesday, the South Metropolitan Gas Company were summoned by the London County Council for supplying at the testing-station in Stoney Street, gas below the legal standard of purity. Defendants pleaded guilty, and attributed to the coal difficulty their failure to comply with statutory requirements. They urged that it was some years since they were convicted of a similar offence. A fine of £3 was imposed on each of three summonses, and £2 2s. costs.

Tapping a Gas-Main at Colne.

At Colne on Monday last week, Richard Berry, an auctioneer, was summoned for unlawfully laying a pipe to communicate with the gas supply, and also for unlawfully burning gas supplied by the Corporation. Defendant pleaded guilty. The Town Clerk (Mr. A. Varley), who prosecuted on behalf of the Corporation, said that the chief gas inspector visited defendant's house on Whit-Monday morning, and found that a piece of india-rubber tubing about 2 feet long had been connected with the main. The meter itself had been removed from its position. Defendant asked the inspector to look over the matter, as the meter had been out of order. The Bench considered the case was one of deliberate fraud, and imposed the maximum penalty of £5 and costs, or one month's imprisonment.

Are Gas-Stove Exhibitors Hawkers?

At the Yeovil Police Court last Wednesday the above question was raised on a charge brought against Edwin Stockdale, in the service of Messrs. John Wright and Co., of trading as a hawker without a licence between Nov. 30 and Dec. 8, 1899. The prosecution was instituted by the Inland Revenue authorities, for whom Mr. Simpson appeared; Mr. J. Trevor Davies representing the defendant. Mr. Simpson said that Messrs. John Wright and Co. were promoters of exhibitions for showing their various manufactures, and they travelled from one place to another. They came from Exmouth to Yeovil, where a Trades Exhibition was given. The Yeovil Inland Revenue officers visited it, and saw Messrs. Wright's gas-stoves exposed for sale. The firm had not a licence. The Magistrates decided that, from the facts placed before them, a licence was required; and they inflicted a fine of £5 and costs. Mr. Trevor Davies asked the Bench to grant a case, which they consented to do.

Contractors' Liability for Parochial Rates.

At the Uppermill (Oldham) Petty Sessions, a case of importance to contractors and rating authorities was heard a few days ago. The Overseers of Saddleworth summoned Messrs. Naylor Bros., Contractors for the new water-works for the Ashton, Stalybridge, and Dukinfield Joint Water-Works Committee in the Greenfield Valley, for payment of certain rates levied upon them. Mr. J. J. Wright appeared for the defendants. Mr. H. Whitehead, rate collector, informed the Bench that the several rates were sanitary, poor, and lighting; and the total amount due was £29 1s. 6½d. This had been demanded in the ordinary way, and payment had been refused. The defendants had had the case before the Assessment Committee on appeal, and the Committee declined to give them any relief. Mr. Wright said his answer was that Messrs. Naylor Bros. were simply licensees of the ground belonging to the Committee; and this being so, they were not liable for the rates. Supposing his clients were contractors for building a certain house in Saddleworth, and they entered the land upon which the house was to be built, they would simply be the licensees of the owner or promoter of that particular scheme for building a house. There would be no question of occupancy whatever, which was the fundamental basis upon which rates were levied. He supposed the Overseers of Saddleworth would not dare to rate any contractor under such circumstances. Mr. Justice Grove had held that a contractor could not be considered to be the occupier of land because he went upon it for the purpose of performing work under his contract. Moreover, section 133 of the Lands Clauses Consolidation Act, 1845, made special provision for promoters of such undertakings as that of the Ashton Joint Water Committee; and they were to make good the poor-rate until the works were completed. The section showed clearly that, pending the completion of the works, the contractors were not rateable. In the present case, the Overseers were actually attempting to assess movable machinery. After hearing evidence, the Bench dismissed the case, but declined to give costs. The tenants of certain huts which had been put up on the ground were then summoned for the non-payment of rates. Mr. Wright explained that these huts were built to accommodate the Contractors' men during the construction of the works, and those who used them were not inhabitant occupiers. He was content, however, to leave the matter in the hands of the Bench. The Chairman said they had decided to make an order for the payment of these rates, amounting to £1 1s. 9½d., and costs.

Yeadon Water Supply.—According to statements made at the meeting of the Yeadon District Council last Wednesday, members have had an interview with the Directors of the Water Company relative to the plumbo-solvency of the water; but the Directors declined to have the water chemically treated, even if the Council defrayed the cost of doing so. After hearing this, it was suggested that the only proper solution of the problem was the purchase of the works; but the Council decided before discussing this matter to lay the whole case before the Local Government Board, and ask their advice.

MISCELLANEOUS NEWS.

MANCHESTER CORPORATION GAS, WATER, AND ELECTRICITY SUPPLY.

At the Meeting of the Manchester City Council last Wednesday, the minutes of the Gas, Water, and Electricity Committees were presented, and those of the two first-named Committees adopted without discussion. The only item of interest in connection with the Gas Committee's recommendations was the acceptance of a tender for the supply of Junkers calorimeters to each of the works, for the purpose of testing the heating power of the gas. The Water Committee's proceedings included a resolution requesting the Finance Committee to borrow on their account a further sum of £100,000, and also a proposal to authorize the Thirlmere Sub-Committee to enter into arrangements with Mr. G. H. Hill, M.Inst.C.E., to become Consulting and Advising Engineer, and to appoint Mr. M. R. Barnett, M.Inst.C.E., to lay the second pipe from Thirlmere, and to take such other steps as might be necessary to carry out the work.

On the motion to adopt the Electricity Committee's minutes,

Dr. Dreyfus drew attention to a proposal that the Chairman, Deputy-Chairman, and five members should be appointed to visit and inspect the exhibits of electrical plant and machinery at the Paris Exhibition. It might, he remarked, be useful and instructive for a deputation to visit the Exhibition, as they could see there many things which would be of great service to them in the work of the department; but, in his opinion, a deputation of two or three members, along with the Engineer, would be quite sufficient. He therefore moved that this recommendation be referred back to the Committee.

Mr. Wilson seconded the amendment; and it was carried practically unanimously.

Alderman Richards, referring to a recommendation of the Committee that a draft agreement should be sent to the Urban District Council of Whitefield, for transferring their Electric Lighting Order to the Corporation, moved, as an amendment, that this be referred back to the Committee. He said he had always been strongly opposed to spending money outside before they had developed their resources in the city itself. They should hesitate before going to an out district like Whitefield, without seeing a probability of recouping something for the outlay. They ought to know what they would get in return. The Committee had spent a large sum of money at Chorlton-cum-Hardy, and he had not heard of more than two applications for electricity in that neighbourhood.

No seconder was found for this amendment, which was therefore not put to the vote.

The annual report of the Electricity Committee was then presented. In the course thereof, it was stated that the total quantity of electricity measured and accounted for during the twelve months ending the 31st of March was 6,468,405 units—an increase of 1,254,184 units, or 24 per cent., on the previous year. The number of consumers was 3240—an increase of 670. The total number of lamps connected was: Incandescent (8-candle power) 237,145, arc 2139; as compared with 188,999 and 1817 respectively in 1898-9. There were also in use 500 motors, representing 2050-horse power; showing an increase on the previous year of 166 motors, equivalent to 890-horse power. The maximum load at any time was 5,607,000 watts. During the year, additional mains were laid to the extent of 83,250 yards, or 47 miles 530 yards; making the total length 110 miles 45 yards. The revenue derived from sales of current, &c. (which worked out at 3·2d. per unit accounted for), amounted to £86,297; and the working expenditure to £49,905—showing a gross profit of £36,392. Out of this sum, interest on mortgage debt, &c., £14,265, and sinking fund, £12,935, had to be met; leaving a net profit of £9192. This, with the balance of £2000 brought forward, and £572 interest on the reserve fund investment, had been employed in the payment of £10,000 to the city fund and £1764 to the reserve fund. The financial position on the 31st of March was as follows: Total capital expenditure, £641,821; mortgage debt, £556,278; amount of mortgages redeemed to date by the action of the sinking fund, £49,232; balance at credit of renewals suspense account, £335; do. of reserve fund, £13,360. Owing to the necessity for renewing a considerable length of mains which had proved defective, the charge upon the revenue account for repairs and renewals of mains this year amounted to £7453, against £1495 before. In addition to this, £12,459 had been taken from the renewals suspense account to cover similar expenditure. Reference was also made to the accident at the Dickinson Street station in September last, which involved the withdrawal of £7069 from the reserve fund on account of the breakdown of plant. The parts of the two wrecked engines and one horizontal engine had since been sold, and on the available space two new direct-driven generators, suitable for lighting and tramway work, each of 1000-horse power, would shortly be erected. Very considerable progress had been made with the laying of electric mains in the districts of Withington, Moss Side, and Levenshulme. The supply of current had been available in portions of Moss Side since December, and in Withington since February. On the 30th of September, the price of electric energy to long-hour consumers was reduced from 1½d. to 1¼d. per unit; and a similar reduction was made in the price of current for motor purposes. This represented a concession of £2873 to the consumers in six months. From an appendix to the report, it appears that the department had 4523 meters in use on the 31st of March.

Alderman Higginbottom moved the adoption of the report and accounts.

Mr. Wilson remarked that there were one or two things in the report which he did not thoroughly understand, and he should like some information on these points.

Mr. Johnston pointed out that there was not a quorum; and the discussion of the report had consequently to be adjourned to the next meeting of the Council.

At a Meeting of the Gas Committee last Friday, it was reported that nearly all the contracts for coal and cannel for the ensuing year had been signed. The Committee will hold a special meeting next Thursday to consider and adopt the annual report of the Gas Department.

PREPAYMENT METERS.

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MOST SIMPLE.
NO WHEELS OR PARTS REQUIRED.

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INSTRUCTIONS.

The Brass Plate has holes around its edge, numbered; these indicate the feet delivered for the Coin used.
To set the Meter, note Figs. I., II., III., IV.

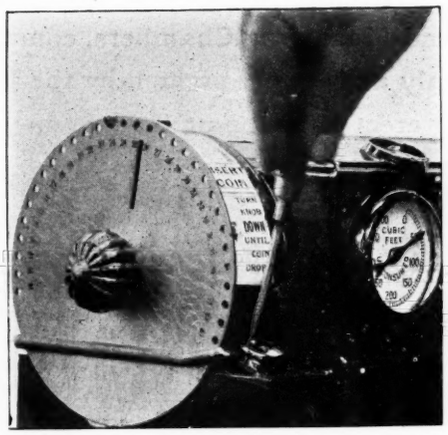

Fig. I.
Break Company's Seal and Remove Screw—THUS.

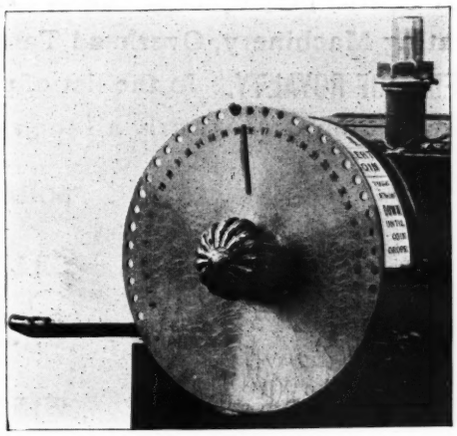

Fig. II.
Swing Band Back—THUS.

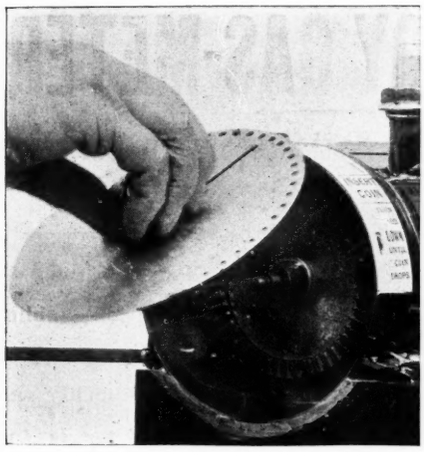

Fig. III.
Lift Plate Off—THUS.

Fig. IV.
Replace Plate—THUS.

Swing Band Forward—Replace Screw—and Re-seal.

NOTHING SO EASY. NOTHING SO ACCURATE.

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We note an Advertisement in the "JOURNAL," under the name of the NEW CONVEYOR COMPANY, stating that they had taken over the business of the AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED; and, as it may create a false impression, we beg to say there are **NO VALID PATENTS** existing in connection with Inclined Retorts (beyond a few small and subsidiary ones, dealing with details).

We are prepared to erect Inclined Retort Plants, with Conveying and Elevating Machinery, Overhead Tanks, Hoppers, and Measuring Chambers, complete and **FREE OF ROYALTY.** In the list of places given, only a few were erected by the New Conveyor Company—nearly all the remainder being erected by the undersigned.

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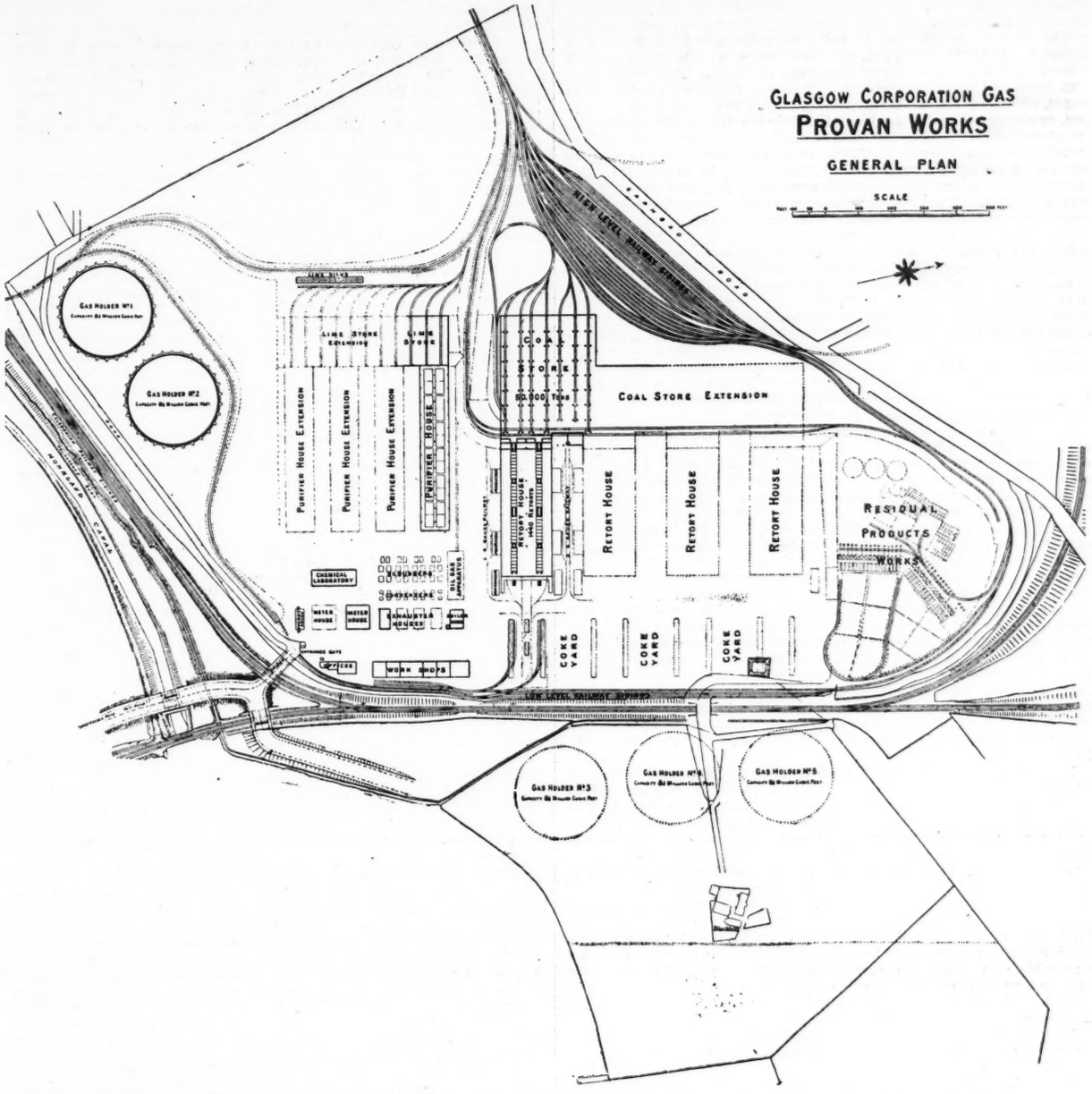

GLASGOW CORPORATION GAS SUPPLY.

New Gasholder Completed—Erection of New Gas-Works Commenced.

Last Wednesday, on the invitation of the Gas Committee of the Corporation of Glasgow, a party of about 200 citizens attended what was popularly described as a small gas function. The Caledonian Railway Company placed at the command of the Committee a special train of most luxurious carriages, in which the several journeys of the day were performed. Meeting on the platform of the Low-Level Central Station, the party travelled by the underground railway to Dawsholm, and thence over a short service into the Temple Gas-Works. When they alighted on the temporary platform which had been erected, they were in close proximity to the large new gasholder which is now all but completed. On the lofty standards of the guide-framing—which rise to a height of 150 feet—flags were flying. Several plates remain to be fixed in the crown, and through the space which they are to occupy a staircase was constructed leading to the floor of the tank. The only daylight which penetrated the interior was by the entrance and by a manhole. There was a row of incandescent gas-lamps at the far side, but so great was the distance, and so numerous the pillars supporting the timber work on which the crown rests, that they had little effect when the company first set foot on the bottom. A weird effect was produced, calculated to give rise to imaginings; but this was not the purpose of the visit. Mr. W. Foulis, the Gas Engineer to the Corporation, when all had gathered within the lamp-lit space, in a few words explained the working of gasholders, introducing his remarks with the observation that they were met in a place where they had never been before, and where certainly they would never be again. The gas, he said, would enter and leave the holder by pipes 3 feet in diameter. The weight of the holder would exert a pressure upon the gas equal to 45 lbs. per square foot. The holder was 240 feet in diameter, and each of the three lifts was of the depth of 42 feet. It was the second largest of three holders which the Corporation had erected during the last eight years; the largest being one adjoining, and the other being at the Tradeston works. It may be stated that the foundation for this three-lift gasholder is on the solid rock, to reach which there was much quarrying of stone of a loose description. In consequence, the cone which has been left is not of the usual symmetrical proportions, but slopes towards one side. As in the other large holders which Mr. Foulis has built, the timber-work beneath the crown will be left in. It is of a very substantial nature. For its support a great number of brick pillars have been erected, in a series of concentric rings. It is almost needless to say that the interior, with its labyrinth of brick and wood work, was a mystification to nearly everyone present.

As the company took their seats in the train, a pamphlet containing the following statement was handed to them: The gas-works have now been in the possession of the Corporation for thirty years. At the commencement of that period, the quantity of gas made per annum was 1296 million cubic feet. During the financial year just ended, the production of gas amounted to 5900 million cubic feet. The increase during each decade is shown in the following table:

Year.	Cubic Feet Manufactured.
1870	1,295,863,000
1880	1,859,582,000
1890	3,058,277,000
1900	5,969,110,800

The existing works have been extended from time to time to meet the increasing demand, until there is now no room for further extension. The necessity for the construction of new gas-works has been evident to the Gas Committee for the last five or six years; and during that time the suitability of a considerable number of sites has been carefully considered. The principal difficulty experienced in the selection of a site arose from the necessity of getting a piece of ground of sufficient extent entirely free from coal workings. In 1898, it was decided to select a site at Provan—which included the lands of Easter Blochairn and a portion of Blackhill and Germiston Estates—as being on the whole the most suitable; and a Bill was introduced into Parliament in the following session to empower the Corporation to purchase these lands and to erect gas-works thereon. The Act was obtained in August, 1899. The area

of the site is 131 acres. It is conveniently situated for both railway and canal communication. The levels are somewhat irregular; but advantage will be taken of the difference in levels to facilitate the transference of material. The coals, lime, &c., will be brought in at a high level, and the coke and other materials sent away at a low level. The works, when completed, will be in four sections, each section forming an independent works, which will be capable of manufacturing 12 million cubic feet per day, or a total of 48 million cubic feet. Only the first section will be constructed at present. This will consist of two retort-houses, 390 feet long by 78 feet wide, each containing 720 retorts; a coal-store, having a capacity equal to 50,000 tons; a purifier-house, 503 feet long by 89 feet wide; also exhauster and meter houses, offices, workshops, &c., and all the necessary apparatus. There will likewise be two gasholders, each capable of containing 8½ million cubic feet. The works have been designed, and mechanical appliances will be introduced wherever possible, so as to reduce the cost of manufacture in every department. A works for distilling tar and ammoniacal liquor will be erected at the north-east corner of the site. The tar and liquor will be pumped direct from the gas-works to these works as produced. Railway siding accommodation will be provided sufficient to deal with 4000 tons of material daily. The total length of railway lines inside the works will be about 8 miles; and in addition there will be about 5 miles of 2 ft. 6 in. gauge lines for conveying coke, waste lime, &c. It is hoped that the first section of the works will be completed in three years; and every effort will be made to accomplish this, as, at the present rate of increase, the producing power of the existing works will be completely exhausted before that time.

After a pleasant journey by the north side of the city, the party alighted at the site of the new gas-works at Provan. There they found that an elaborate system of wooden gangways had been laid down. A few yards off was a plank with a barrow. Thither repaired Lord Provost Chisholm, ex-Bailie R. M. Mitchell, Mr. Foulis, and Mr. R. M'Alpine, sen., of the firm of Messrs. M'Alpine and Sons, the Contractors for the whole of the excavation and structural work of the new works. Mr. Foulis said he did not know that it was necessary that he should make any lengthened remarks describing the works, because there had been put into their hands a short description of them; but he thought he might point out that the position they were in at that moment was on the edge of one of the gasholders which they intended to construct. The capacity of this gasholder, they would see from the description, would be from 8½ to 9 million cubic feet. The ceremony of cutting the first sod was performed by Lord Provost Chisholm; ex-Bailie Mitchell, the Convener of the Gas Committee, wheeling the barrow and tipping the contents—over the side—amid cheers. Thereafter Mr. M'Alpine presented the Lord Provost with a beautiful silver-gilt spade, bearing an inscription, and ex-Bailie Mitchell with a solid silver, heavily-chased, punch bowl, with a similar inscription, as mementoes of the occasion. Both gentlemen suitably acknowledged the gifts.

Since they purchased the site, the Corporation have been fortunate in discovering a valuable seam of clay in it, out of which they are making all the bricks which will be required in the erection of the works. The company proceeded to inspect the brick-making process. There are two machines, by Messrs. Bradley and Craven, of Wakefield. The clay is first dried on the floor of a shed, which is heated by the waste steam from the engine. It is then ground in three rolling mills, elevated to the flat above, and sent down to the machines, where it is moistened, worked, and pressed into bricks, the machines working continuously and without noise. By the two machines working night and day, 40,000 bricks can be made in 24 hours. Women take them away from the machines and wheel them to the kilns, of which two have been erected on the Hofman principle, each containing 14 chambers. The bricks are of a hard and compact nature when fired, and are expected to be very durable. Messrs. M'Alpine and Sons' contract amounts to £200,000. The ironwork has still to be contracted for.

Thereafter luncheon was served in the drying shed of the brick-works, which was profusely decorated for the occasion. After the customary loyal and national toasts,

The Lord Provost proposed "The Gas Committee, and prosperity to their new undertakings inaugurated to-day." It was now, he said, thirty years since the Corporation of the city of Glasgow undertook the manufacture of gas. Prior to that time the concern was carried on by private Companies working only for private profit. At that time, in the year 1869, the Corporation of Glasgow bought over the Companies that were then existing; and since that date had carried on the enterprise for the sole benefit of the citizens of Glasgow. It was very interesting and instructive to note one or two points of difference between then and now. The price of coal to-day was rather more than double the price it was in 1869; but the price of gas, which in 1869 was 4s. 7d., was to day 2s. 2d. So that, in spite of an increase of more than 100 per cent. in the price of coal, there had been a diminution of more than 100 per cent. in the price of gas. If anything more than this needed to be said in token of the excellent work which the Gas Committee of the Corporation of Glasgow had carried on, he did not know what that thing could be. And while this was so, the mere statement of the figures did not by any means convey the importance of the truth which the figures set forth; for it was difficult to imagine what an advantage it had been to the city in having the streets better lit and all the common stairs compulsorily lit, and in having cheap gas provided for those smaller manufacturers who find that gas-engines suit their purpose admirably. Thus, by the success of their labours, the Gas Committee had done not a little to foster the trade and commerce and general well-being of the city. No wonder if, when these things were so, the consumption of gas had increased to such an enormous extent as the little pamphlet which Mr. Foulis had put into their hands showed. In the year 1870, 1,295,863,000 cubic feet of gas was manufactured; whereas in 1900 it was 5969 millions, and he could not tell how many hundreds of thousands. He had not only to propose the Gas Committee, but he had to propose prosperity to their new undertakings now inaugurated. They had had the pleasure of visiting the enormous new gasholder at Dawsholm; and they had taken part in inaugurating this fresh undertaking of an entirely new gas-works at Provan. He thought these enterprises demonstrated the courage of the Gas Committee and their Engineer, and of the Corporation, in facing such an enormous expenditure, although irrespective of the booming of the electric light which was going on all over the city and over the land; and he was satisfied that the courage which the Engineer and the Committee and the Corporation had manifested would be abundantly justified by the result, and that in the years to come they would have simply a repetition of the continual growth and progress of their gas-works to chronicle—that gas would not be displaced by electricity, but that there was room in the city for both.

Ex-Bailie Mitchell, in acknowledgment, said they all rejoiced to see their worthy Lord Provost there. He felt that, perhaps, the Lord Provost had said too much about the Gas Committee. Whatever might have been the shortcomings of the Gas Committee, he thought they might justly claim to have done a little towards the prosperity of the city. He might even go the length of saying that, till recently, the Gas Committee had been rather a popular one—popular in this way, that every year they had been able to give a record of success in their working. The Corporation had not much time to deal with their successes; they had been received with satisfaction, he believed, but very quickly disposed of, and the energies of the Corporation had been directed in picking holes in matters which had, perhaps, not been quite so successful. Unfortunately, to-day they were under a cloud. Ever since he had been in the Corporation, only once had the price of gas been raised, thanks to the wonderful efforts of the Gas Committee. So far as he could remember, from 3s. 6d. per 1000 cubic feet they had reached the very modest rate of 2s. 2d. Perhaps the citizens had not taken advantage of the 2s. 2d. as much as they ought to have done; but now they were compelled to increase the price by a few pence, though he did not yet know how much. Some people thought the gas should never go up, but always come down; others thought that some dreadful mismanagement must have taken place, and that they must have a new Convener. There were some people, he believed, who were willing to accept the office; and he had only to say that if it was on a rising market, he would be very glad to let them have it. It was not their fault that the price of gas had gone up. He believed that their efforts had been more assiduous during the past year than they ever had been. He thought that their Engineer had been doing even more than his best in order to economize, to keep down the price of gas; but there were other influences abroad. Of course, the hope among people was that this time of abnormal prices would soon cease; and he was sure he joined with them—at least, as Convener of the Gas Committee. He was sure they would be astonished to see there that they had in view a great new enterprise. It required, as the Lord Provost said, some courage to face it; and he thought it needed some confidence in their Engineer that they were going on with it. They had been told that by-and-bye they should be snuffed out by the electric light. Their Electricity Committee was a very useful one, and a very distinguished one. They had lighted a good many houses and warehouses, and so on, in the city, to the satisfaction of the owners; and they wished them every success. In all great communities it had been found that the progress of electricity and the progress and prosperity of gas went hand in hand. He trusted that this would be so in the future, and that they would be able to congratulate each other that the profit of the one had been to the advantage of the other.

Bailie Fife proposed "The Engineer of the Department." He said there were four departments which might claim to hold a prominent place in the Corporation—the Water, the Electricity, the Tramways, and the Gas. These were all commercial departments, which might claim to be profit-earning departments. Possibly some critics might say that they should be left entirely to private enterprise; but they said that these were the departments which belonged to the citizens of the Municipality, and they believed that in taking these four spending departments in hand they had done a great work for the citizens. It was an honour to propose the health of Mr. Foulis, the Gas Engineer. Mr. Foulis had been their Engineer during the whole time the Corporation had owned the gas undertaking; and he had risen to the occasion. The duties which he entered upon in 1869 were comparatively small. The revenue then was somewhere about £235,000 a year. In the year that had just closed, the returns would show a revenue of about £770,000. Thirty years ago their expenditure upon works had been somewhere about £535,000; now they had spent close upon £1,500,000 irrespective of the work they were now beginning. They had reduced very considerably the price of gas; while at the same time they had written off for depreciation over £1,000,000, and set apart a sinking fund of £347,000. They were indebted to Mr. Foulis for a great part of what he had mentioned. He had been the backbone of the work since he came among them thirty years ago. And they had had services from him, not only of a clerical character, but a great part of his work had been thorough brain work—engineering work. During the whole of these years, they had not invited the assistance of outside engineering in order to extend their great works, or to build the large works they were now entering upon. The whole of the engineering work, the brain work, the skilled work, had been done by Mr. Foulis, and by the staff under his control. He said, therefore, that in Mr. Foulis they had a public servant who had given them a noble and splendid service. They wished him health and prosperity, that he might be spared to see the completion of these works, and that they would be carried out in the spirit which had been voiced by the Lord Provost and Mr. Mitchell.

Mr. Foulis, in responding, said he thought that there was nothing that stimulated and encouraged a public servant, or indeed any man, more than to feel that he had the confidence of those who employed him, and that his work was appreciated, whether that work was great or small. And he could assure them that their appreciation of any efforts that he had made to develop this great undertaking would simply have the effect of stimulating him to greater exertions in the future. There was no use denying that the works inaugurated that day were very extensive. They were works which, when completed, would make rather more gas than the whole of the stations they now had in Glasgow. At present their works were capable of making 33 million cubic feet of gas a day; those just inaugurated would be capable of manufacturing 48 million cubic feet a day. This seemed a very large quantity. Forty million cubic feet a day meant a consumption of considerably over 4000 tons of coal per day, and with coke and other materials it meant the transference and the dealing with something like 6000 tons of material every day. It might be thought that they were looking forward to a very large prospective increase; but if the figures he had given were looked at, it would be seen that in the last ten years they had exactly doubled the consumption. So that, if the consumption went on increasing in the same ratio, ten years hence the works now inaugurated would be no more than capable of supplying the town.

Then it might be thought that electricity and other means of lighting would probably check the consumption of gas. This was not the experience of any town either in this country or on the Continent, and more especially on the Continent, where electricity had been developed at a rate much greater than in this country. The gas companies and corporations had not been able to build gas-works as fast as was necessary to meet the demands. He believed that the same thing would be experienced here; and he had no doubt that the Corporation would have to go on building as fast as ever they could. The designing of such a work had been a matter of very great consideration. It was not an easy task to start on a piece of ground and lay it out so as to produce work which would be satisfactory to the Corporation, and which, he hoped, would be a credit to himself; but the matter had been very carefully considered, and he had no doubt they would find when these works were completed that they would give every satisfaction.

Other toasts were given; and the party then travelled to the Central Station, where the day's proceedings came to an end.

THE NEWCASTLE AND GATESHEAD GAS COMPANY AND THEIR EMPLOYEES.

Award of the Umpire on the Wages and Holidays Question.

Our readers may remember that in November last the National Amalgamated Union of Labour made application on behalf of the members employed at the Elswick and Redheugh works of the Newcastle and Gateshead Gas Company for certain advances of wages and other alterations in the terms of their employment, as follows: (1) Retort-house men employed at carbonizing, 1s. per shift advance on the present rate of wages; double tim e for Sunday work for all three shifts; double time for Good Friday; 14 days' holiday without loss of pay; and all casual or winter hands to receive holiday pay at the same ratio. (2) Yardmen, an advance of 10 per cent. on the present rate of wages, with double time for Sunday work; one week's holiday without loss of pay, and all existing privileges. (3) The men in the sulphate of ammonia house to have an advance of 10 per cent. on the present rate of wages, and one week's holiday without loss of pay. On the 10th of February last, as stated in the "JOURNAL" at the time, it was agreed between the parties that the Company should grant to the workmen an advance of 2½ per cent. upon their then present rate of wages, such advance to take effect from the 1st of February, and that the remainder of the claims should be settled by arbitration; the court to consist of an Arbitrator on each side and an Umpire, the latter appointment to be made by the Board of Trade under the Conciliation Act, 1896, in the event of the Arbitrators failing to mutually agree on this matter. The Company appointed Mr. T. Newbigging; and the workmen, Mr. Alexander Wilkie, of Newcastle, the Secretary to the Shipwrights' Society, as their respective Arbitrators; and as they failed to agree as to an Umpire, the Board of Trade appointed Mr. George Ranken Askwith, of the Temple, Barrister-at-law. The court sat in the Board-room of the Company on the 17th and 19th of May—Mr. R. W. Cooper appearing for the Company, and Mr. E. Clark on behalf of the workmen—when oral and documentary evidence was brought forward by both parties. The court sat again in London on the 29th of June, when the Umpire heard the arguments of the Arbitrators, and on the 3rd inst. he issued his award, as follows: "(1) With respect to the claim of the retort-house men employed at carbonizing for double time on Good Friday, I allow the said claim. (2) I award and determine that the existing conditions of Sunday work for the retort-house men and yardmen shall remain unchanged. (3) I award and determine that the existing conditions of holidays for the retort-house men and yardmen and men in the sulphate of ammonia house shall remain unchanged. (4) I award and determine that the present rate of wages, in addition to the 2½ per cent. already agreed to, shall be increased from the 8th day of February, 1900 (the date agreed to), by a further amount of 1½ per cent. for the retort-house men employed at carbonizing and the yardmen and the men in the sulphate of ammonia house."

SALFORD CORPORATION GAS UNDERTAKING.

Annual Report—The Coal Contracts.

At the Meeting of the Salford Town Council last Wednesday, the annual report of the Gas Committee was presented. It stated that the business of the department continued to advance; the increase for the year ended March 31 last being equal to 10·89 per cent. The coal and cannel carbonized during the year amounted to 147,181 tons; and the quantity of gas made was 1,539,374,000 cubic feet, of an average illuminating power equal to 19·44 candles. The cost of coal was considerably more than in the previous year; but the receipts from the sale of coke, tar, and sulphate of ammonia had greatly increased. The works and plant had been maintained in a thoroughly efficient condition; and arrangements had been made to increase the size of the trunk main supplying the Broughton district. Resolutions were submitted confirming the recommendations of the Gas Committee with respect to the acceptance of tenders for the supply of coal to the gas-works and other departments. Mr. Thompson said he would like to know, in view of the increase in the price of gas, what was the extra amount that was being paid for coal. Alderman Phillips (the Chairman of the Gas Committee) stated that the amount was between £20,000 and £30,000. Mr. G. T. Jackson complained that the resolutions did not state the amounts of the tenders. He thought that, when the Council were asked to vote for large sums of money, they should have the figures before them. He had been told that even in Committee the figures were seldom given. Alderman Phillips demanded to know Mr. Jackson's authority for making this statement. Mr. Yearnshaw remarked that the prices were always tabulated and read out to the Committee. Mr. Jackson said he had made no charge, and was quite satisfied with the disclaimer. Alderman Phillips said he was not permitted to state publicly the prices which were paid for coal. The Council had decided this; the reason being that the Gas Committee was a trading committee. The prices, however, would be found tabulated upon the paper which he held in his hand; and any member of the Council could inspect it. Full publicity was given in the Committee to all facts and figures. The resolutions were carried.

THE TRANSFER OF THE PORTLAND GAS-WORKS TO THE LOCAL AUTHORITY.

Our readers will doubtless remember that some short time ago negotiations were set on foot for the transfer of the Portland Gas-Works to the Urban District Council. Mr. W. A. Valon was consulted on the matter, and eventually purchase was agreed upon at his valuation—£28,656—and a Bill is now in progress to sanction it. As at present arranged, the works will pass into the hands of the Council on the 1st of October, and come under new management. It may therefore not be out of place to briefly review the progress of the undertaking in the 6½ years during which the present Manager (Mr. C. Jeffery) has been associated with it. When he took up his duties, the annual make was 10 million cubic feet; it is now 17½ millions. The leakage account, which was large, owing to the scattered nature of the district and traction-engines passing up and down the streets with heavy loads of stone behind them, has been reduced by about half. This economy must have been effected with some difficulty, for there is also a 15-ton steam-roller used on the streets, and as many as four mains have been broken in one week. Portland being a very hilly place, much care has been required to regulate the pressure, and Cathels governors have been fixed in various parts of the district. In the above-named period, the gas-stove business has been introduced; and at present the Company have in use 168 of Fletcher's cookers. Two years ago they adopted penny-in-the-slot meters, and of these there are 86 fixed. The number of meters has risen from 252 to 508; and that of the public lamps from 163 to 186. Of course, various extensions have been carried out, comprising a set of three 10-feet square purifiers, a gasholder to contain 70,000 cubic feet, and a 4-horse power Crossley gas-engine to drive the exhauster. A good deal of the Company's success as regards extra consumption may be attributed to the way in which the consumers are looked after. At the commencement of the warm season, the Company send round men to examine the cooking-stoves; and if any repairs are required, they are executed free of cost, and the stoves put in thorough working order, so that there can be no complaints as to insufficient supply of gas. When the dark days set in, an examination is made of the fittings; and the Company do any slight repairs necessary, and supply the consumer with suitable burners free of charge, so as not to leave them in the hands of local fitters. This system has been found to pay better than anything else. The Council will take over a concern which has gradually been improved; and it will be for them to follow the course which has led to its present prosperity, and adopt such changes of policy as they may be advised to increase it in the future.

PROPOSED SECOND GAS AND ALLIED TRADES AND ACETYLENE EXHIBITION AT THE AQUARIUM.

In view of the success which attended the first Gas and Allied Trades Exhibition, held at the Royal Aquarium, Westminster, at the close of the past, and early in the present year, the management are making arrangements for holding a second, from Dec. 21 next to Jan. 22, 1901. The exhibits will comprise appliances for the production, storage, conveyance, measurement, and consumption of gas, and its utilization for cooking, heating, and motive power, including traction. All kinds of apparatus for showing the different systems of gas lighting—comprising compressors, incandescent mantles, and burners—as well as art metal work in connection therewith, will be on view. It is intended to make a special feature of the acetylene section of the exhibition, for which, if necessary, the St. Stephen's Hall (adjoining the Aquarium) will be reserved. Appliances for the generation, purification, and consumption of acetylene gas will be shown, and its applicability for railway carriage as well as ordinary lighting demonstrated. It is proposed to have the appliances in this section tested by experts during the exhibition, and gold, silver, and bronze medals, and possibly diplomas, will be awarded for the most efficient. As the exhibition will open after the great show in Paris is closed, it is anticipated that many of the firms exhibiting there will transfer their articles to the Aquarium direct. This building possesses, as was proved early in the year, special advantages for having such a display as that now projected—the position being central, and the main hall particularly well adapted for showing off all kinds of illuminants; and the hope is entertained that, in addition to the original exhibitors, many firms unable to be associated with them on the first occasion will be represented on the second. The organizer of the exhibition is Mr. M. J. G. Ritchie, Royal Aquarium, S.W.

Water-Gas Plant for Darlington.—At the meeting of the Darlington Town Council last Thursday, the report of the Gas Committee stated that the Engineer had reported that, in his opinion, a new gasholder, costing £30,000 should be obtained, and that a carburetted water-gas plant should be erected. Alderman Barron moved that application be made to the Local Government Board for power to borrow £8000 for the purpose of installing the water-gas plant. Some of the councillors wished the matter to be postponed for further consideration, as the medical faculty in the town were opposed to water gas on sanitary grounds. The matter was adjourned for a week.

No Increase in the Price of Gas at Tipton.—At the last meeting of the Tipton District Council, Mr. D. Hipkins made a statement which the gas consumers have no doubt received with pleasure. He said that gas corporations all over the country were raising the price of gas; this being found necessary in consequence of the increase in the price of coal, which amounted to about 25 per cent. Their own gas-works last year returned, after paying principal and interest on loans, a profit of £800, which was applied to the reduction of the rates. The expenditure on coal had advanced £2000 per annum; but they anticipated an increase in the value of the residuals. The works were not started with a view to profit so much as the advantage of the parishioners; and the Committee had thought it desirable that the gas consumers should have the benefit, and had decided that there should be no increase in price during the next twelve months. If residuals advanced in value to the anticipated degree, they would still have a profit.

THE RATING OF PUBLIC COMPANIES.

The following is practically the full text of the memorandum on the above subject prepared by Mr. H. Wilkins, Secretary of the Lambeth Water Company, for the Royal Commission on Local Taxation, and referred to in the letter from him which appears in our "Correspondence" columns to-day. It will be seen that it contains the proposition for making gross profits the basis of rating, to which allusion was made at the close of Mr. F. J. Bancroft's paper on "The Rating of Water Undertakings" read at the recent meeting of the British Association of Water-Works Engineers, and given, with the discussion thereon, in the "JOURNAL" last week.

The foundation of the present system of local rating generally was laid in 1601, when the Poor Relief Act was passed; one of its provisions requiring the Overseers to levy a poor-rate by taxation of every inhabitant, &c., in such competent sum or sums of money as they shall see fit. Early poor-rates appear to have been levied according to the assumed means of the person assessed; but the necessity of some principle being adopted soon became apparent. Judicial decisions limited liability to the poor-rate to permanent residents having visible property in the parish; and, legally, personal property was liable to be rated until 1839, although in practice it had then long ceased so to be. It was also judicially decided that the rate must be equal, and that all must be rated on the same principle. With regard to other local rates, the Legislature appears to have recognized the equity of assessing property in proportion to the benefit derived by the property assessed from the expenditure of the moneys raised. Thus, by the Lighting and Watching Act, 1833, owners and occupiers of houses are to pay a rate in the pound three times greater than the owners and occupiers of land; and the same principle is observed in the Public Health Act, 1875. Public companies have reason to complain (1) that rates are not levied on the same principle in their case as in others; and (2) that they are rated far above the benefit they can by any possibility derive from the expenditure of the local rates. Their grievance is now very substantial, because they have no control over local expenditure, being even deprived of votes for members of Local Boards; and local rates have, of recent years, in many cases doubled, and in some more than trebled in amount.

As to the first cause of complaint, the undertakings of companies are assessed upon income, which is not the principle adopted for assessing manufacturers' and traders' premises generally. Machinery and apparatus, too, which are required for the purposes of their business, are assessed; while coffee-mills of grocers, show-cases of jewellers, vats of brewers, and machinery and apparatus required for some other businesses, are exempt. Again, although a main laid underground derives positively less benefit from the local rates generally than lands—used as market gardens, for instance—it is actually assessed at three or four times the amount. This cannot be said to be equal rating, or rating on the same principle. As to the second cause of complaint, it is manifest that a pipe laid underground cannot derive the same benefit from police or education rates, for example, as a house of equal value full of valuable goods requiring to be guarded, or of children to be educated. But in practice the main is assessed at least upon the same basis. In order to carry out the principle of contributing according to benefit, underground works, which cannot possibly derive the same benefit as inhabited or business premises, should be assessed at a lower pound rate—in fact, the principle of rating lands and railways under the Public Health Act, 1875, should be extended to works of this nature.

But in addition to suffering from inequality before the law, companies are seriously hit by the practice which has gradually grown up, in spite, as will hereafter appear, of protests of the Courts, of estimating the gross annual value, which is the basis of assessment, upon imaginary figures. The law is simplicity itself. It merely requires such concerns to be rated on the basis of rental value, exactly like any other hereditament. But the difficulty is to apply the law equitably to various classes of property for which no rent is, or is likely to be, paid or offered. The first step is to ascertain the gross annual value, which is defined by law as being "the annual rent which a tenant might reasonably be expected, taking one year with another, to pay for a hereditament, if the tenant undertook to pay all usual tenant's rates and taxes and tithe commutation rent-charge, if any, and if the landlord undertook to bear the cost of the repairs, insurance, and the other expenses, if any, necessary to maintain the hereditament in a state to command that rent." The rateable value is such annual rent, "after deducting therefrom the probable annual average cost of the repairs, insurance, and other expenses as aforesaid." On this rateable value the property is to be assessed to the local rates.

It is submitted that the custom of assessing the undertakings of public companies on the basis of income is contrary to the intentions of the Legislature, and that it is distinctly the duty of rating authorities to ascertain the annual rent which a tenant might *reasonably* be expected to pay. The question is, How is this to be done? If a yearly tenant could be found for an undertaking of such magnitude and offering such contingencies as a London Water Company, for instance, he clearly would not pay a rent which did not leave a sufficient margin to cover expenses, interest on his working capital, risks of various kinds, and personal remuneration proportionate to the extent of the business. As an actual tenant is not forthcoming, a hypothetical tenant is now created, and the rating surveyor comes in with a whole host of hypothetical figures. By disallowing expenses incidental to every-day trading, which ought to be deducted and excluded from rating, and by adopting arbitrary and capricious methods of calculating tenant's interests and statutable deductions, the surveyor is able to calculate a hypothetical rent at a figure approximating (or even exceeding) the gross profits. It surely was never the intention of the Legislature to subject public companies alone to a local as well as to a national income-tax.

In the absence of an actual rent, how, then, can an assumed rent be arrived at on some uniform and intelligible principle? Capital outlay alone, or income alone, would not serve as a satisfactory basis, even if it were legal, because outlay and income do not always stand in the same ratio. A landlord might be content with a well-secured clear 4 per cent. on his outlay, while a tenant might be willing to pay more or decline to pay so much according to the return he can see upon his capital and labour. An analogy may be found in house property. A shop affording additional facilities for trade, such as a return frontage or a back entrance, may command a higher rent than a shop which cost considerably more to build but does not possess these facilities. But it must never be forgotten that it is rental value and not profit which legally forms the basis of assessment in all cases.

What is required is not to create a hypothetical tenant and estimate the rent he can afford to pay, but to ascertain the rent which a tenant may reasonably be expected to pay. This point seems to be generally overlooked by rating surveyors, who, moreover, take extraordinarily divergent views of apparently simple facts. Everybody who has had practical experience in the rating of the undertakings of public companies will appreciate the truth and force of the observations on this point made by Mr. Loveland Loveland in delivering the considered judgment of the County of London Sessions, on April 6, 1897, in the case of *The London and India Docks Joint Committee v. The Assessment Committees of the Poplar and Woolwich Unions*, as reported in "The Times" of the following day. He said:

> In these cases, as in many other rating appeals which have been tried before us, we have had very little assistance from the valuers of the respective parties. First of all, in the Poplar Union, the present net rateable value appealed against is £61,200, whereas in the respondents' case the figures for the rateable value amount to £99,598. Mr. Eve (one of the surveyors called) puts these figures at £86,805, although five years ago it was agreed that this Court should assess the property at £54,315. On the other hand, the appellants were willing before the Assessment Committee to compromise and settle the net rateable value at £51,328 for the parishes in this Union; but here the appellants have asked for the assessments to be reduced to £35,000 rateable, and their valuers afterwards gave evidence that these hereditaments ought only to be assessed at £16,127. In the Woolwich Union case, we find the respondents have more than doubled the old assessments for the part of that system now under consideration, which stood in 1890 at £10,375 gross and £7500 rateable, but now appear in the rate-books at £19,375 gross and £15,500 rateable. The appellants are desirous of being assessed at £10,465 gross and £7500—practically the old figures. Of course, the valuers on both sides in this case also gave evidence of figures which would show a good margin on behalf of their respective clients. Secondly, we find that the valuers for the respective parties have not valued on the same basis. They have worked out their figures on different principles; and we disagree in some points with each mode of calculation.

The views of Mr. Loveland Loveland are by no means either novel or peculiar to himself. As far back as 1859, Mr. Justice Wightman, in the case of *Regina v. West Middlesex Water-Works Company*, expressed a hope that the Legislature might make some provision adapted to the rating of such companies by declaring the principle upon which they are to be rated, and establishing some uniform and practical mode of carrying that principle into effect. In 1863 the Court of Queen's Bench, constituted of Lord Chief Justice Cockburn and Justices Crompton, Hill, and Blackburn, in the case of *Sheffield United Gaslight Company v. Overseers of Sheffield*, while following the decision of the Court in the case of the West Middlesex Company, with some hesitation, referred to and emphasized the remarks of Mr. Justice Wightman in that case; remarking that the rule they felt bound to adhere to does not seem strictly theoretically right, and that they agreed with him in thinking that it is practically impossible to satisfactorily apply the Parochial Assessments Act to such properties.

It is evident, therefore, that the Courts, as well as companies, and no doubt rating authorities, would welcome an alteration in the existing practice which would simplify the mode of calculating or arriving at the rateable value.

After careful consideration, and in the light of experience, both from a rating authority's and a company's point of view, I venture to suggest that the system of rating the undertakings of companies would be placed upon a simple and intelligible basis, in entire conformity with the spirit of the existing law, if the gross annual value were to be calculated at a specified percentage on the capital outlay (or on so much thereof as represents property which is legally rateable), varying according to the amount of gross profits. The following scale would meet most if not all cases, although it is possible that different classes of property might require different scales, which could be fixed by rules of Court or by the Local Government Board: If the average gross profits do not exceed 1 per cent., the gross annual value to be taken at 3 per cent. on the rateable capital outlay, and for every additional 1 per cent. of gross profits the gross annual value to be increased by ¼ per cent. on such capital outlay. If it is thought that more frequent variations in the scale would be more equitable, every ¼ per cent. of profit might increase or reduce, as the case may be, the percentage on rateable capital outlay for calculating the gross annual value by $\frac{1}{16}$ per cent. The scale, at variations of 1 per cent. in the profits, would work out as follows:—

Gross Profits not exceeding	Gross Annual Value.*	Gross Profits not exceeding	Gross Annual Value.*
1 per cent.	3 per cent.	6 per cent.	4¼ per cent.
2 "	3¼ "	7 "	4½ "
3 "	3½ "	8 "	4¾ "
4 "	3¾ "	9 "	5 "
5 "	4 "	10 "	5¼ "

In order to arrive at the "rateable value," the cost of repairs, insurance, &c., must be deducted from the gross annual value. For mains 10 per cent., for buildings from 15 to 20 per cent., and for machinery from 20 to 25 per cent. of the gross annual value might perhaps be taken as a fair average. It is therefore suggested that an all-round deduction of (say) 15 per cent. should be made.

Having thus arrived at the rateable value of the undertaking as a whole, the next step is to divide the rateable value between works and what are commonly described as "dead mains" (including trunk mains) and directly productive mains. It is suggested that the rateable value of works should be taken at 4 per cent. on the capital outlay—the balance being the rateable value of productive mains. Capital outlay, it is suggested, is the most equitable basis that can be adopted for the valuation of works—firstly, because it represents actual and not imaginary figures; and, secondly, because lands, &c., have, speaking generally, been acquired under parliamentary powers, and therefore never below ordinary market value. It may be added that the works have not uncommonly been con-

* To be calculated at per cent. on rateable capital outlay.

structed piecemeal, and therefore probably at a somewhat greater expense than if they had been constructed at one time. Alterations and additions are notoriously costly.

The following hypothetical case will illustrate the application of the foregoing suggestion: Suppose an undertaking has cost £1,860,000, is situate in 25 different parishes, has a gross revenue of £270,000 a year, and earns a gross profit of £149,000 a year. A gross profit of £149,000 is just over 8 per cent. on a capital outlay of £1,860,000, so the gross annual value would be 5 per cent. on the capital outlay, or £93,000. Allowing a deduction of 15 per cent., the rateable value would be £79,050. This would be apportioned as follows:—

Station A	cost	£120,000,	at 4 per cent. =	£4,800
B	,,	90,000	,, ,, =	3,600
C	,,	300,000	,, ,, =	12,000
D	,,	50,000	,, ,, =	2,000
E	,,	30,000	,, ,, =	1,200
F	,,	10,000	,, ,, =	400
Trunk mains	,,	200,000	,, ,, =	8,000
Total rateable value of works				£32,000
Leaving for productive mains				47,050
Rateable value of whole undertaking (as above) .				£79,050

The stations would be assessed at their respective rateable values in the parishes in which they are severally situate. The rateable value of the trunk mains would be divided according to their size and length in the several parishes, as represented by original cost; and the productive mains would be apportioned, as now, according to the revenue derived from the several parishes. It will be seen that the rateable value of the productive mains on this basis would work out at 17·42 per cent. on the gross revenue of £270,000. Such a percentage would at one time have been regarded as a high figure, although parochial rates then were, broadly speaking, half their present amount in the pound.

As the accounts of the London Gas, Water, and Electric Light Companies are certified by Official Auditors, no question can arise as to the amount of the capital outlay or gross profits.

It is submitted that if legislative effect were given to the foregoing plan, the objections raised by the Courts to the present system would be entirely met. In considering the application of this suggested plan to the case of undertakings earning a small amount of profits, it must be remembered that the works are rateable so long as they are occupied, although the business may not be remunerative. Occupation, and not profit, is the test of liability to rates, just as rental value, and not profits, is the measure of such liability.

It may be added that "gross profit" means, for the purpose of the foregoing scheme, the divisible profit—that is, the sum available for paying dividends on ordinary and preference capital, and interest on debenture stock, loan capital, or borrowed money. Rebates to consumers, as in the case of Water Companies earning more than their maximum dividends, are in no sense profits, and must be deducted from the revenue to arrive at the gross profit. Such companies and gas companies paying full dividends would be assessed according to their actual divisible share of the profits earned. They clearly ought not to be rated on money which they actually return to their customers in one way or another.

It is submitted that the system herein suggested would place the rating of properties of the nature referred to on a simple and intelligible basis; that, while it is more readily understood, it is at the same time more scientific, and would give more uniform results than the method now in vogue; and that it would be a return to the true principles of the law of rating, from which a wide departure has been made by the varying methods of valuation adopted by rating surveyors.

PROPOSED AMALGAMATION OF JOHN WRIGHT AND CO. AND THE EAGLE RANGE AND GAS-STOVE COMPANY.

The shareholders of Messrs. John Wright and Co., Limited, will have submitted to them to day a scheme for carrying into effect an amalgamation of the concern with the Eagle Range and Gas-Stove Company, Limited, provisional arrangements for which have been completed. It will assume the legal form of a purchase of the undertaking of the latter Company for shares in the former. The respective capitals of the two concerns stand thus: John Wright and Co., 6 per cent. cumulative preference (£5 shares), £60,000; ordinary (£5 shares), £60,000. Eagle Company, 6 per cent. cumulative preference (£5 shares), £25,000; ordinary (£1 shares), £30,000. The following are the heads of the provisional agreement: "(1) The capital of John Wright and Co., Limited, shall be increased by £103,000, divided into 5000 6 per cent. cumulative preference shares of £5 each, and 78,000 ordinary shares of £1 each. (2) Out of such increased ordinary capital there shall be issued for the purpose of, and prior to, the amalgamation 40,000 shares of £1 each; 20,000 of such ordinary shares will be issued to the Managing-Directors in lieu of future remuneration by commission, and the remaining 20,000 shares as a special dividend of 33⅓ per cent. in shares to the ordinary shareholders of John Wright and Co., Limited. (3) The property and undertaking of the Eagle Range and Gas-Stove Company, Limited, shall be acquired as from Dec. 31, 1899, for the sum of £61,297, payable as to £25,000 in 5000 6 per cent. cumulative preference shares of £5 each, ranking *pari passu* with the existing issue, and as to £36,297 in 36,297 ordinary shares of £1 each. There will also be issued to Harry James Yates 1403 ordinary shares, and to Wyndham Charles Brodie 300 ordinary shares as part consideration for entering into agreements to act as Managing-Director and Manager of the Company respectively, which will be submitted to the shareholders. (4) The new preference and ordinary shares shall rank for dividend as from Dec. 31, 1899, but shall not be entitled to participate in the dividends declared on March 8, 1900, for the year 1899, nor in the special dividend in shares above mentioned. (5) Each existing ordinary share of £5 fully paid shall be subdivided into five ordinary shares of £1 each fully paid. (6) The name of the Company shall be changed to John Wright and Eagle Range, Limited."

A circular embodying the terms of the amalgamation has been also addressed to the shareholders of the Eagle Range and Gas-Stove Company.

ELECTRIC LIGHTING NOTES.

The Local Government Board have sanctioned the borrowing by the West Bromwich Town Council of £30,000 for electricity works.

The Hornsey District Council, after a discussion lasting several hours, late on Monday night last week resolved to carry out their own Provisional Order, and borrow £73,500 to enable electric lighting works to be commenced.

The financial progress of the Bury Corporation electric lighting undertaking is not by any means rapid. During the past year, a profit of £183 has been made, which compares with an adverse balance the previous year of £336.

The big electric lighting undertaking of the Croydon County Council has produced them the little net profit of £900 on the past year's working. No one seems particularly gratified with this; but, by way of apology for the smallness of the sum, the Chairman (Alderman Miller) states that, if they had not adopted the maximum demand system, the profit would have been £2900. It was anticipated that the maximum demand system would have attracted consumers; but the anticipation has not been met by realization.

The Sleaford District Council are pushing forward with their proposed scheme of electric lighting. No sooner has their Provisional Order received the Royal Assent than they resolve to petition the Local Government Board for sanction to borrow £7000 with which to instal the light—the Engineer's estimate being £6500. When the matter was being discussed last Wednesday, it was contended by Mr. Ward that the electric light would only benefit a few of the leading tradesmen at the expense of the ratepayers generally. We have an idea that time will show Mr. Ward is about right.

In many parts of Birmingham the supply of electric light suddenly ceased on the evening of Sunday, the 1st inst., about half-past nine. The deficiency was rectified as speedily as possible, but a good deal of inconvenience was necessarily caused. The mishap was due to the current having short-circuited. The result was almost terrifying at headquarters, where one of the men in charge was temporarily blinded by a sudden burst of brilliancy, and one of the dynamos caught fire. The mischief was located in Bull Street; and after this thoroughfare had been switched off, the supply to other parts of the city was promptly restored.

Mr. H. Percy Boulnois has held an inquiry at Wakefield, on behalf of the Local Government Board, with respect to an application by the City Council for sanction to borrow £25,000 to extend their electric lighting works. It was explained to the Inspector that the sum now asked for included £7854 spent in excess of the original loan. At the close of the inquiry, Mr. J. M'Girr, an old member of the Corporation, called the attention of the Inspector to the excess of expenditure on the previous loan. He objected to this state of things, and pointed out that if the Board refused to sanction the excess, the amount would have to be included in the current rate instead of being repaid as a loan spread over a long period. The Inspector agreed with Mr. M'Girr, and said the City Council ran great risk in exceeding the loan allowed.

At their meeting on Wednesday, the members of the St. Helens Town Council received from the Mayor a brief sketch of the progress of matters electrical in the borough. He said that on March 31, 1898, 4526 lamps were connected. The cost to produce the current was 4·04d. per unit, and the total cost 6d.; while the sale was above 35,000 units to 63 consumers. In 1899 they had 6463 lamps; the works cost had dropped to a little over 3d.; the total cost to rather less than 4½d.; and 65,091 units were sold to 79 consumers at the price of 6d. At the end of March this year, they had 13,981 lamps connected; the works cost had gone down to less than 1d.; and the total cost to nearly 1½d. The sale was 320,160 units, which, of course, included that supplied for the trams. The number of consumers was 190; and there had been an increase in the supply for motors. The output for May was 57,434 units, which was at the rate of 689,000 units per annum, or about double the output last year. Seeing that May was one of the lightest months of the year, the increase was most promising. A profit of £10 12s. 7d. was made last year; but this would be increased next year.

The minutes presented by the Electric Lighting Committee at the last meeting of the Hanley Town Council contained the recommendations of the Sub-Committee referred to in our "Notes" last week, and their own in regard to increasing the charges for electrical energy. Alderman Hammersley having moved the adoption of the minutes, Mr. Coates seconded the motion, and made an elaborate statement in defence of the recommendations; claiming that, while difficulties had been experienced by the Committee, they had not been greater than those usually met with in the control of extensive new undertakings. He pointed out that in the early days of gas lighting, gas companies had many difficulties to contend with; and they must be expected in the initial stages of electric lighting. Other towns, he contended, had had greater breakdowns than they had had at Hanley. In comparison, they had done very well; and their loss was practically *nil*. With regard to calling in an expert, he contended that such a step would be a mistake. They had only to work with one of the best engines, and he would ask them to wait and see what it would do, and how cheaply it could be worked; and if, at the end of a year, it was not being run properly, they might call in an expert. Alderman Cooke said he felt very strongly that the advice of an expert was needed; and he moved an amendment to the effect that the Electric Lighting Committee call in the best assistance available to aid them in reporting upon the undertaking. On being put to the vote, the amendment was lost by 12 votes to 10; and the Committee's recommendations were then adopted.

[In the paragraph on electric lighting at Hastings, in last week's "Notes," Mr. C. F. Botley, whose letter on the subject to a local paper was being dealt with, should have been described as Assistant Gas Engineer and Electrician to the Hastings Gas Company—he, of course, holding no appointment under the Corporation. In the quotation from the letter, the misprint of "custodians" for "customers" of the electric light, which appeared in the cutting from the paper, was inadvertently reproduced. It may be mentioned that the figures given for the Brighton general district rate are, as is usual, for the half year.]

NEW YORK WATER SUPPLY.

(*Concluded from p.* 1742 *of Vol.* LXXV.)

In the previous instalment of the review of Mr. John R. Freeman's report on the above subject which we reproduced from the "Engineering Record," his striking revelation of serious errors in the records of the run-off of the Croton watershed was dealt with, as well as his studies to prove the serious waste of water going on in the boroughs of Manhattan and the Bronx. It is now proposed to give his analysis of the various sources of waste and consumption, and the remedies proposed.

The Central Park experiments already referred to indicate that the total waste averages at least 80 gallons per head per day, of which 10 gallons may be regarded as incurable. This leaves 70 gallons as the probable needless waste in the mains and service, although Mr. Freeman states that unknown sources of error in these experiments may show that the amount is less. It is said that 50 gallons is a certain minimum figure for the needless waste. There is little doubt that this waste arises from the following causes: (1) Leaky house plumbing; (2) old, leaky, and abandoned service-pipes; (3) water-cocks unnecessarily left open by the careless 10 or 20 per cent. of the householders; (4) the leaky joints in New York's 833 miles of pipes, and occasional rust-holes and cracks in osme of the pipes laid many years ago; (5) a possibly relatively small quantity diverted through surreptitious connections, but not enough to be of any material account in the total distribution.

With regard to leaky house plumbing, there are no data for anything but a guess as to how much of the 50 or 70 gallons per inhabitant per day escapes through leaky plumbing, and how much through leaks in the streets. Judging from isolated examples in New York, and by what has been temporarily accomplished by house-to-house inspection in other cities, or permanently maintained by universal metering, it appears only reasonable to suppose that out of the total leakage and waste of 50 or 70 gallons, the leaks through defective plumbing, together with the careless and wilful waste inside dwellings, amount to from 30 to 50 gallons per inhabitant per day. This is a waste from three to four times as great as the total actual use in the fully metered cities. It is also difficult to subdivide and attribute a definite part of this waste to either cause. But for a guess we may reckon that two-thirds of this 30 to 50 gallons of house waste escapes through poor plumbing, and the other one-third through careless or wilful waste.

The greatest cause of house waste is undoubtedly cheap and neglected plumbing fittings, and among these tank ball-cocks are doubtless the chief offenders. The fastening of cocks open, and letting the water run unnecessarily, is also a great source of waste. One cause of the smaller consumption in certain English cities is probably the rigid requirements in force for the inspection of fittings. Brightly polished fittings look very much alike when new, and considerable loss results in time from those which are light or soft or of cheap design. But with the compression cocks shutting against leather or rubber or fibre discs, common in all American plumbing, it is more often a question of neglect to supply a new disc or washer than of leakage caused by wear or yielding of the metal. For the underground plug cocks, the corporation cocks, or the cellar stop-and-waste cock, there is a temptation to cheapen the cost of manufacture by adding lead to the mixture of tin and copper, or to use the cheaper alloy, soft yellow brass, consisting only of a mixture of spelter and copper—thus giving a metal which can be worked in the lathe at high speed and with broad cuts.

The experience in those American cities which are fully metered appears sufficient proof that each householder will become a fairly good inspector of leaky plumbing if he has a water-meter in the cellar, and that reputable plumbers will supply their customers with proper fittings without the inconvenience and expense of a Government inspection, if the customer finds it to his pecuniary advantage to prevent waste of water through leaky appliances. The great objection urged against meters is the fear that they will tend to a harmful restriction of the use of water in the houses of the poor or in tenement blocks, where the landlord may not be of the most liberal class, and would try to save water, if metered, at the expense of his tenants' health and comfort. This is a matter which can be solved, in Mr. Freeman's opinion, after proper study, by some system of separate meters, combined with a carefully considered scale of minimum charges. The reliable answer is found in the text of experience. No complaint, so far as Mr. Freeman knows, now exists in Fall River, Providence, Worcester, Lawrence, Syracuse, or Poughkeepsie, that the comfort or health of any class in the community suffers because of the complete application of meters.

New York unfortunately has no means of differentiating the waste inside houses from the waste in the mains. There is every reason to infer that the street-pipe waste is very much larger than the 7 gallons per inhabitant per day found in the cities of Woonsocket and Fall River, where the streets are less disturbed, the pipes not so old, and where, from metering water into the distribution and then metering it out again, they keep account of the discrepancy, and trace to its source any abnormal leakage. In Boston, fractured 12-inch pipes have been found with water leaking freely, and 4-inch pipes broken short off and the water finding its way into the sewers without a sign on the surface; while in other cities similar cracks and breaks are often found leaking badly, without showing any sign. It appears that part of New York's oldest pipes were cast on the side in a manner which leads to weakness, and that other old pipes near the water front had been found badly corroded from the salt water in the ground. It is stated that many wrought-iron service-pipes exist—that perhaps one-third of all those in Manhattan and the Bronx, and one-tenth of all in Brooklyn, are wrought iron, the others being of lead; and it is known, from experience elsewhere, that unprotected wrought-iron pipe often becomes badly eaten by rust when buried in damp earth. It has been asserted on excellent authority that a common trick of the plumber is to double-back the end of the pipe next the cellar wall, hammer it together, and then leave it. The service-pipes in New York are not attached to the main by screw-threads, as is the common practice elsewhere, but are hollow tapered brass spigots driven into a hole in the cast-iron pipe. A strain on the pipe, due to settlement, may pull these out.

It can never be known with any degree of accuracy what was the extent of the underground leakage in the streets until there is a meter on every tap, and a daily estimate is made of all water used for public purposes and for fires. Then, by subtracting what is measured out from what is measured into the distribution system, the difference will show the leakage. This kind of measurement in Fall River and Woonsocket, with the allowance for a smaller number of joints and of service-pipes in New York, gives the ideal of 5 to 10 gallons per inhabitant per day for the maximum leakage from mains and service-pipes towards which the water distribution service of Greater New York should tend. To attain this ideal will require years of patient work and very heavy expenditure.

To find the leaks in the 1500 miles of cast-iron mains in Mahattan and Brooklyn, and to locate among the 200,000 service-pipes in these two boroughs those which are leaky, and to find and plug off the 25,000 more or less abandoned service-pipes, a part of which are, without doubt, leaking badly, and all likely to leak sooner or later, is an enormous task. The remedy cannot be applied quickly enough to help out the imminent shortage in the present water supply, but is a task for twenty years' steady, patient, broadly-planned work. To find a large leak now, or to know where to look for the worst leaks, is like hunting for the proverbial needle in the haystack. Before we can stop the leaks, we must find them; and no better or more economical method now appears for finding the worst leaks first, than the following: Each borough should be subdivided into districts, averaging (say) half a mile square in Manhattan and Brooklyn, following ward-lines where practicable. All water-pipe connections across the district boundary should be stopped excepting three. The water-pipes should be fed through two connections at most—the third being in reserve and shut ordinarily; a Venturi meter being on each of the two in use. This will show day by day the total quantity of water delivered into each district. Occasionally, by the same meters, measure the rate of flow at intervals of five minutes throughout the 24 hours, to get the relation of the night flow to the day flow, and thus determine the total leakage and waste for this selected area, much as was done for the whole city in the Central Park experiments. From the records of the forthcoming census, find the population dwelling in each district. From the Water Register's meter records, find the average daily consumption of metered water for all manufacturing and commercial uses within the district. There will then be available for each district the average rate of total consumption and waste, of night waste, and that of total real use and of manufacturing and commercial use, per 24 hours. From the known population in the district and the character of the houses, a fairly close estimate can be made of the probable real domestic use; and this, added to the manufacturing and commercial use, will check with the determination by the night flow. The total of all the Venturi meters should be checked against the recorded delivery of the aqueducts. Having all this information for each district, those districts in which the leakage is worst can be picked out and placed first in order for further study.

The next proper step would appear to be to begin in those districts where the greatest waste is found; to apply a water-meter to every tap not now so provided; and to keep, with the assistance of Street Department, Fire Department, and Sewer Department, an approximate daily record of the amount of water drawn for flushing, fires, &c. This is found practical and easy in certain other large cities, and could doubtless be readily accomplished throughout New York. Adding the total of the meter readings in the district for each quarter, the average daily use and waste inside houses and commercial buildings would be known; and knowing what was measured into the pipes of each district through the Venturi meters, and deducting from this what was measured out through the service meters, *plus* the draught for fires, flushing, and street sprinkling, there would be for the first time in New York definite knowledge of the amount leaking through defective joints in main-pipes and throughout all the old, leaky, and abandoned service-pipes.

Since to uncover, recalk, and relay any large proportion of the 1500 miles, more or less, of cast-iron mains in Manhattan, the Bronx, and Brooklyn would be a work of many years, with such breaking up of streets at one time as the public would probably tolerate, and since the immediate relaying of any large proportion of the 200,000 service-pipes would, for similar reasons, be inexpedient, it is important to discover and remedy the worst cases first. To discover and locate the worst leaks or the street blocks containing them, the districts mentioned above should be temporarily subdivided into sections about 1000 feet square, by closing the water-gates, and each section fed through a Deacon meter. Then proceeding by the regular Deacon method, one street after another should be temporarily shut off by night, by closing the gates at the intersections of streets, and the effect noted on a leakage diagram. Taken in connection with a special reading of the service meters through this section, this would plainly indicate which streets should have the main-pipes and services first overhauled. It does not appear reasonable to expect that this hunting down, locating, and remedying the thousands and probably hundreds of thousands of underground leaks throughout New York could be at best accomplished in ten years; and Mr. Freeman's present views are that the far-sighted and proper course would be to adopt such a pace, and steadily pursue it, that twenty years hence every main and service-pipe about which there can be any suspicion of weakness or leakage would have been overhauled and replaced, or made strong enough for a regular working pressure of 100 lbs. per square inch, and all fire hydrants meanwhile brought up to date. This could be readily accomplished with no heavy burden on the water-rates, if spread over a period of twenty years.

After having studied these matters as thoroughly as possible in the time at his disposal, Mr. Freeman concludes that the one efficient, practical, and economical method of preventing waste begins with a meter on every service-pipe, domestic as well as commercial. At the same time it must be admitted that public sentiment in New York, as in Philadelphia and other large American cities, appears to be almost hopelessly against the universal application of domestic meters. That this comes from lack of understanding the matter fully, he has no doubt. It is his further opinion that the city should, at its own expense, and through its own workmen, put in all meters; that the meters should be periodically tested and kept in repair by the Public Water Department; and that the city should furthermore put in at its own expense, and maintain, all service-pipes between the meter and the main. He thinks that systematic work in this direction should be at once begun, looking to the city examining and replacing all service-pipes the tightness of which there is any doubt, at

some fixed rate of progress per annum, in view of the entire overhauling and remodelling of these within a period of (say) 20 years, relaying them with fewer main arteries under the roadway, branching near the kerb into the several buildings, and with a kerb stopcock on the pipe into every building—at the same time making all new pipe thick and strong enough to stand a future working pressure of 100 lbs. per square inch. Taking the work up in this manner, systematically, with the aim and end continually kept in view of having all doubtful pipes relaid and made good within twenty years, would not seriously burden the water debt revenues, and the twenty years would quickly pass.

The system of a meter on every tap is slowly but steadily gaining ground in the smaller American cities. It was followed largely from the first in Fall River, Woonsocket, Providence, and Worcester, and has been extended recently to cover a large percentage of all the services of Syracuse, Lawrence, Lowell, Milwaukee, Poughkeepsie, and Newton (Mass.), and has everywhere met with success in greatly lessening the waste of water or in holding the consumption per head (use and waste combined) stationary against the great tendency to increase from year to year, found in the unmetered cities.

We must be governed by the facts, says Mr. Freeman, in conclusion, as to what the public now draw and the present pipe-waste, and by our best judgment as to what the public will use and the existing pipes continue to waste, rather than by our opinion of what the public ought to use; and, above all, our figure must be a safe one. The safest guide is to note that New York and Brooklyn now use less per head than any of the other large American cities, with the single exception of St. Louis, and that the rate of consumption in New York is steadily increasing; also to further note what very eminent engineers, thoroughly familiar with all these facts regarding waste and the small proportion really used, have recommended in other cities. A large water supply cannot be had quickly; and if we get one that is too large at first, the growth of the population will soon come up to it. The Commission of experienced engineers who recently investigated the water supply of Philadelphia strongly recommended the application of water-meters to substantially every tap, and based their designs upon a consumption of 150 gallons per inhabitant per day. The Commission which reported upon the improvement of the Cincinnati supply in 1896 based their designs on 130 gallons, coupled with an expressed expectation that "a more earnest effort to prevent unnecessary waste would be adopted by the city." In planning for the Massachusetts Metropolitan Water System, Mr. Dexter Brackett, who probably has a richer fund of experience in water-waste prevention to draw upon than any man in the United States, after very careful analysis recommended that estimates for the supply of the Boston Metropolitan District for the next thirty years should be based on 100 gallons per inhabitant per day, assuming a greater restriction of waste than has been made. The actual consumption throughout this district four years later (in 1899) averaged about 110 gallons per inhabitant daily. The reasonable and proper restriction of waste looked for by Mr. Brackett has, unfortunately, not yet begun.

After careful consideration of the matter of the actual increase of consumption in New York, and in the light of the use and waste of water in other large American cities, and in view of the fact, clearly brought out by diagrams given in the report, that with the increasing number of fittings in houses the legitimate use of water per head is steadily growing and the waste also tending to increase, and after reviewing what has been actually accomplished in Boston and various other cities in restriction of waste, and the lack of permanent reform, Mr. Freeman does not consider it safe or prudent to base the estimate of the future needs of the boroughs of Manhattan and the Bronx on less than the following rates of average consumption in gallons per inhabitant per day, including all use and waste: With the greatest effort to restrict waste that public sentiment will probably demand or support—In 1905, 125; in 1910, 130; in 1915, 135; in 1920, 140; in 1925, 145; in 1930, 150. With matters continued as at present: In 1905, 140; in 1910, 155; in 1915, 170; in 1920, 180; in 1925, 190; in 1930, 150.

For Brooklyn and Queens, the probable future consumption is taken at 80 per cent. of the above quantities. For Richmond, a still smaller consumption is estimated, based on the ordinary experience in similar communities. It is dangerous to its public interests to be too hopeful about preventing waste when estimating the date when the new supply must be available, or in estimating its necessary magnitude; for with these hopes unfulfilled, and the reservoirs emptied, the disaster would be beyond remedy.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

We are accustomed to speak of an outstanding occasion as a "red-letter day," or an "oasis" in the ordinary hum-drum of life. Last Wednesday was such a day in the Glasgow Corporation Gas Department. For a year or two workmen have been excavating and constructing at the Temple Gas-Works one of those huge holders of which the Corporation now possess three. Their labours are all but finished; and the Gas Committee went out to see the work. Then, from work completed, they turned their faces towards work contemplated, at Provan. There is to be no halt in the onward march of the gas supply. The past has shown a steady increase in the consumption of gas; and the experienced eye of the Engineer (Mr. W. Foulis) looks into the future, and sees it still rising. It is refreshing to notice how simply the case for gas can be stated. While Glasgow flourishes, so will the manufacture of gas in its midst; and while Mr. Foulis directs the gas undertaking, it will, as it has all along, be conducted upon the most advanced lines. This was the feeling which underlay all the speaking which took place on Wednesday. Mr. Foulis enjoys the utmost confidence of the Corporation. He is able to devote his whole capacity to the working of the undertaking; and the result is unbroken success. Of what engineer can it be said that for thirty years no outside advice has been required or sought? There could be no better testimony to the good management of the undertaking than this. The example of Glasgow should appeal with overwhelming

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 79.

Issue.	Share	When ex-Dividend.	Dividend on Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment	Issue.	Share.	When ex-Dividend.	Dividend on Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.	£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	17½—18½	..	5 13 6	60,000	5	Feb. 23	7	Ottoman, Ltd.	5—5½	..	6 7 3
100,000	10	,,	7½	Do. 7 p. c.	12½—13½	..	5 11 1	500,000	100	June 1	6	People's Gas 2nd Mtg. of Chicago Bonds .	102—106	..	5 13 2
800,000	100	July 2	5	Australian 5 p. c. Deb. .	101—103*	+1	4 17 1								
270,000	5	May 16	6	Bombay, Ltd.	6—6½	..	4 12 4	851,070	10	Apl. 27	7	River Plate Ord. . . .	10—10½	−½	6 13 4
40,000	5	,,	6	Do. New, £4 paid .	4—4½	..	5 6 8	250,000	Stk.	June 28	4	Do. 4 p. c. Deb. .	100—102*	..	3 18 5
880,000	Stk.	Feb. 23	12	Brentford Consolidated	250—260	..	4 12 4	250,000	10	Apl. 11	8	San Paulo, Ltd.	11½—12½	..	6 8 0
270,000	,,	,,	9	Do. New . . .	182—187	−3	4 16 3	135,000	Stk.	Mar. 14	10	Sheffield A.	246—247	..	4 1 0
50,000	,,	,,	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0	209,053	,,	,,	10	Do. B.	244—246	..	4 1 4
159,375	,,	June 14	4	Do. 4 p. c. Deb. .	116—120	..	3 6 8	447,427	,,	,,	10	Do. C.	244—246	..	4 1 4
220,000	Stk.	Mar. 14	11½	Brighton & Hove Orig. .	220—240	..	4 15 10	5,600,000	Stk.	Feb. 23	5⅝	South Metrop., 4 p.c. Ord.	127—132	+1½	4 0 10
226,320	,,	,,	8½	Do. A. Ord. Stk. .	175—180	..	4 14 5	1,520,000	,,	Jan. 12	3	Do. 3 p. c. Deb. . .	97—99	..	3 0 7
999,500	Stk.	Feb. 23	5	Bristol, 5 p. c. max. .	125—130	..	3 16 11	380,940	Stk.	May 16	5	Southampton Ord. . .	115—120	..	4 3 4
420,000	20	Mar. 29	10	British	39—41	..	4 17 7	70,825	,,	Dec. 29	4	Do. 4 p.c. Deb.	120—125	..	3 4 0
50,000	10	Feb. 23	12	Bromley, Ord. 10 p. c. .	24—26	..	4 12 4	120,000	Stk.	Mar. 14	6	Tottenham and A. 5 p.c. B. 3½ p.c.	120—125	..	4 16 0
79,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8	250,520	,,	,,	4½		93—98	..	4 11 10
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	9—9½	..	6 6 4	55,100	,,	June 14	4	Edmonton 4 p. c. Deb.	111—115	..	3 9 7
220,000	Stk.	June 14	4	Do. 4 p. c. Deb. .	99—101	..	3 19 3	182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
150,000	20	Mar. 14	8½	Cagliari, Ltd.	24—26	..	6 6 11	149,900	10	July 2	5	Do. 5 p. c. Deb. Red.	98—102*	..	4 18 0
100,000	10	June 14	8	Cape Town & Dis., Ltd.	13½—14½	−½	5 10 4								
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	55—57	..	5 5 8								
550,000	Stk.	Apl. 11	13⅜	Commercial Old Stock .	275—285	..	4 14 9								
236,425	,,	,,	10⅞	Do. New do. .	210—220	..	4 15 6								
238,237	,,	June 14	4½	Do. 4½ p. c. Deb. .	133—138	−2	3 5 8								
800,000	Stk.	May 31	9	Continental Union, Ltd.	155—165	..	5 9 1					WATER COMPANIES.			
200,000	,,	,,	7	Do. 7 p. c. Pref. .	170—175	..	4 0 0	780,399	Stk.	June 28	11	Chelsea, Ord.	293—303*	..	3 12 7
51,600	Stk.	Feb. 23	14	Croydon A 10 p. c. . .	335—340	..	4 2 4	150,000	,,	,,	5	Do. 5 p. c. Pref. .	155—160*	..	3 2 6
173,400	,,	,,	11	Do. B 7 p. c. . .	265—270	..	4 1 5	160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	143—148*	..	3 0 10
555,000	Stk.	Feb. 23	5½	Crystal Palace Ord. 5 p.c.	116—120	..	4 7 6	175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb. .	145—150	..	3 0 0
60,000	,,	,,	5	Do. 5 p. c. Pref. .	130—135	..	3 14 1	1,720,560	Stk.	Apl. 11	7	East London, Ord. . .	190—195	..	3 11 10
486,090	10	Jan. 26	11	European, Ltd.	19½—20½	..	5 7 4	654,740	,,	June 14	4½	Do. 4½ p. c. Deb. .	142—147	..	3 1 3
354,060	10	,,	11	Do. £7 10s. paid .	14½—15½	..	5 6 5	890,000	,,	,,	3	Do. 3 p. c. Deb. .	96—98	..	3 1 3
14,993,075	Stk.	Feb. 9	4⅛	Gas- 4 p. c. Ord. . .	97—99	..	4 19 0	700,000	50	June 14	7½	Grand 10 p. c. max. .	104—107	..	3 10 1
2,500,000	,,	,,	3½	light 3½ p. c. max. .	95—97	−1	3 12 2	810,000	Stk.	Mar. 29	4	Junction 4 p. c. Deb. .	130—135	..	2 19 3
3,799,735	,,	,,	4	and 4 p. c. Con. Pref.	117—119	..	3 7 5	708,000	Stk.	Feb. 23	14	Kent	307—312	..	4 9 9
3,993,975	,,	June 14	3	Coke 3 p. c. Con. Deb.	95—98	..	3 1 3	160,000	,,	,,	7	Do. New, 7 p. c. max. .	200—210	..	3 6 8
70,000	10	May 31	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4	1,043,800	100	June 28	10½	Lambeth, 10 p. c. max. .	285—290*	..	3 12 5
2,800,000	Stk.	May 16	10	Imperial Continental .	198—203	−2	4 18 6	406,200	100	,,	8	Do. 7½ p. c. max. .	203—208*	..	3 16 11
473,600	Stk.	Feb. 9	3½	Do. 3½ p. c. Deb. Red.	100—103	..	3 8 0	850,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb. .	130—133	..	3 0 2
75,000	5	June 14	6	Malta & Medn., Ltd. .	4½—5	..	6 0 0	500,000	100	Feb. 23	13½	New River, New Shares	422—427	..	3 3 2
560,000	100	Apl. 2	5	Met. of 5 p. c. Deb.	107—110	..	4 10 11	1,000,000	Stk.	Jan. 26	4	Do. 4 p. c. Deb. .	132—137	..	2 18 5
250,000	100	,,	4½	Melbourne 4½ p. c. Deb.	106—108	..	4 3 4	902,300	Stk.	June 14	7½	South- Ord. . . .	195—200	..	3 15 0
541,920	20	May 31	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 8	136,500	100	,,	7½	wark 7½ p. c. max. .	182—187	..	4 0 3
667,946	Stk.	Feb. 23	9½	Newc'tle & Gatesh'd Con.	215—220	..	4 4 1	489,200	Stk.	,,	5	and 5 p. c. Pref.	155—160	..	3 2 6
299,855	Stk.	June 28	3½	Do. 3½ p. c. Deb. .	104—107*	..	3 5 5	1,019,585	,,	Apl. 11	4	Vauxhall 4 p. c. A Deb.	129—134	..	2 19 9
150,000	5	May 16	8	Oriental, Ltd. . . .	7½—7¾	+⅛	5 8 3	1,155,066	Stk.	June 14	10	West Middlesex . . .	275—280	−5	3 11 5
135,000	5	,,	8	Do. New, £4 10s. pd.	6¾—6¾	..	5 6 8	200,000	,,	,,	4½	Do. 4½ p. c. Deb. .	145—150	..	3 0 0
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1¾	..	4 11 6	200,000	,,	Mar. 14	8	Do. 8 p. c. Deb. .	99—101	..	2 19 5

* Ex. div. *Ex div.

eloquence to those public men in divers places who look upon the gas manager as the best of all game to shoot at.

The new gasholder at Temple is almost similar in size and design to the other two. There is very stout lattice-girder guide-framing; and the timber work supporting the crown during construction is allowed to remain in. How puny the gasholders which were once looked upon as large appear by the side of these leviathans! The other large holder was up for the occasion, which gave visitors an idea of what the new one would be like. This new holder will raise the storage capacity in Glasgow to about 29 million cubic feet, which is not far off the maximum day's consumption. It thus places the gas supply of the city on a sounder basis than it probably ever has been. Were it not for the constantly advancing demand, the gas staff might now give their energies a rest. Such, however, is not to be. The step which is about to be taken is the biggest stride which has been attempted in Scotland. But a few words more about the holder. Had the company not been taken into its interior, a grand opportunity of impressing the Corporation with the magnitude of the work would have been missed. The pillars which have been left in to support the crown were a mystery. Still more so was the idea that the whole of the space to the surface of the ground was to be filled with water, which some thought was waste. It was apparent, from questions put by the visitors, that a man may be thoroughly familiar with the knotty problems that are met with in the markets and exchanges of the world, and yet be strangely ignorant of the elementary principles of engineering. Thus the visit was more an impressive than an instructive one.

At Provan, the ceremony was of a different nature. There is no mystery about the lifting of a spadeful of earth; and a good luncheon is satisfying to the erudite as well as to those who are less so. The interest in the proceedings lay in the imagination. In a year or two, where there are green fields to-day there will be a busy hive of industry—the largest of its kind north of the Border—a gas-works in which mechanical skill and discipline will go hand in hand in the production of the best possible article at the lowest possible price. Looking at the ground plan which was furnished to every member of the party, along with a short description of the works, it is seen that the utmost simplicity of design has been followed. The productive department is to be begun in the centre, a retort-house and purifier-house standing side by side; and future extensions are to work outwards—a retort-house on one side and a purifier-house on the other. Coal-stores are to be at one end of the retort-houses, on a high level, and the coke-yards at the other end, on the low level. Similarly with the purifier-houses, the lime-kilns and lime-stores are to be at one end, and the exhausters, condensers, scrubbers, meters, and governors at the other. The oil-gas apparatus will also be stationed there. The sketch shows, further, that the retort-settings are proposed to be in twelves; but, of course, it will be a long time before they are erected, and other arrangements may be made. There is also provision for the supply of gas for heating the retorts by outside producers. As yet there is not much appearance of works on the ground, though I was informed that some of the foundations were well in. These do not show very much. What is most apparent is a series of railway sidings and drains, with a large excavation for No. 2 holder. It was No. 1 holder which the ceremony was connected with; and in regard to it all that had been done was to mark off its site by a row of tiny Union Jacks. These two gasholders are all that are proposed in connection with the first section of the works; but there is ample room for further gasholder extension, as for the other portions of the works. There is a good deal of excavation work to be done; but the stuff appears to be easy to handle, and there is reason to believe that the Contractors (Messrs. R. M'Alpine and Sons) will be able to complete their work within the time limit. Mr. M'Alpine said he was keeping his eye upon this. When it arrives, it will be about time to enter upon another contract.

The Gas Engineer to the Edinburgh Corporation (Mr. W. R. Herring) has prepared a table showing the output of gas during the past financial year in Edinburgh, Leith, and Portobello to have been 1,882,831,000 cubic feet, as compared with 1,784,251,000 cubic feet in 1898-9—an increase of 98,580,000 cubic feet, or 5·52 per cent., against 4·40 per cent. in the preceding twelve months. Taking the past ten years, there has, with two exceptions (1892 and 1893, when the price of gas was raised), been an augmentation in the annual output.

Everyone is full of congratulation to Mr. Hubert Pooley on his transfer from Dunfermline to Stafford. The output of gas in Stafford is more than double what it is in Dunfermline, so the promotion is a very marked one. Mr. Pooley, during his stay in Dunfermline, has endeared himself to his brethren by the earnestness of his attitude upon all questions which came before him. He had hard work to begin with, the plant and mains being greatly worn out; but he braced himself to it, and he leaves a legacy of easier times to his successor. The estimation in which Mr. Pooley was held was shown by his elevation to the presidency of the North British Association of Gas Managers, which office he held last year. So, while the memory of him will be sweet in Scotland, his recollections of his short stay here will be also of a felicitous nature. He was trusted to the full by his Commissioners; and, in turn, he served them to the best of his capacity. The Commissioners are advertising the vacancy; and it has been pointed out to me that the salary they are offering is £300, which is what is paid by the Perth Gas Commissioners, where the business is twice the size it is in Dunfermline.

The Town Council of Aberdeen, on Monday, agreed to the recommendation of the Gas Committee to charter the same steamship for a further twelve months for the carriage of gas coal, at the rate of £232 10s. per month. There was no dispute about this. But the Committee also recommended that the contract with the stevedore who discharged the cargoes be renewed for the year, on the present terms of 8d. per ton; and to this the Trades Union section of the Council made some objection. The stevedore employs non-Union men, and they are satisfied with the wages they receive. The representatives of the Dock Labourers' Union believe that the wages are not those of the Union; and they wanted the Council not to contract at all, but to employ labourers direct, with a man over them. The Council were too shrewd to adopt such a method of working; and they rejected it by 21 votes to 9. It would be putting too much power into the hands of the Trades Unionists to lay down any rule which would place the coal supply to the gas-works in their hands.

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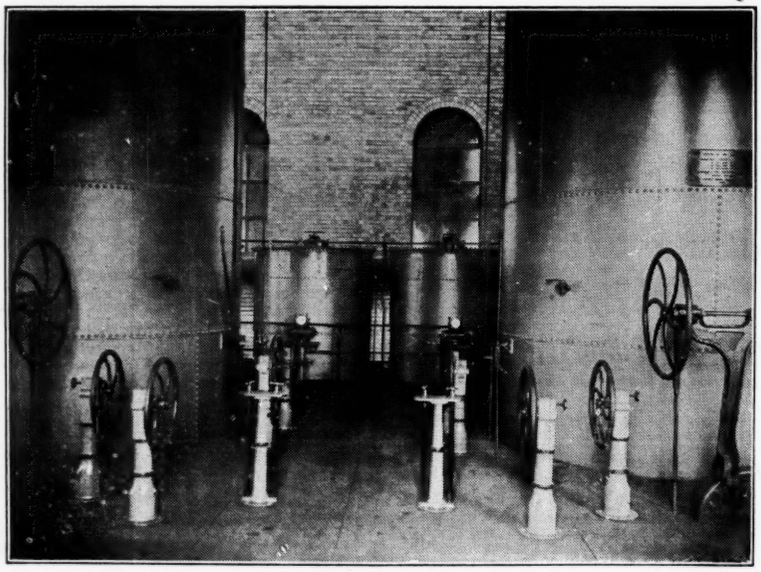

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.

The Maximum Daily Capacity of the Birmingham Corporation's Plant, which was erected by this Company, is 10 MILLION CUBIC FEET.

The report of the Directors of the Kirkcaldy Gas Company for the past year states that there has been a satisfactory increase in the quantity of gas manufactured. It is proposed to pay a dividend at the rate of 7s. 6d. per share. The Directors point out that last year, though there was a rise in the price of coal, they did not increase the price of gas, as was done in some other places. They are pleased that the year's working justified their recommendation; but they are now reluctantly obliged to recommend that the price of gas be raised from 3s. 1½d. to 3s. 7½d. per 1000 cubic feet.

The Motherwell Gas Company had a total income last year of £12,820, and an expenditure of £9038; leaving a balance to profit and loss account of £3782. The amount received for residual products was £1516, as compared with £1078. A dividend at the rate of 10 per cent. has been paid.

The annual meeting of the shareholders of the Hawick Gas Company was held last Thursday. The Directors recommended that the price of gas should be fixed at 3s. 9d. per 1000 cubic feet; being an increase of 5d. per 1000 cubic feet, consequent on the advance in the price of coal. The Chairman, in moving the adoption of the report, stated that the Company had used £1333 worth more coal during the past year. The profit of the year was £1120. They estimated that the increased cost of coal for the current year would be £1500; this causing an increase in the price of gas. They had sold over 5½ million cubic feet more than in the preceding year. This was the largest consumption the Company had ever had; and it spoke well for the Company, and for the trade of Hawick. He thought that the Directors and Mr. Smith, the Manager, deserved great credit for the way the business had been conducted. The report was adopted, and a dividend of 10 per cent. was declared.

The Directors of the Saltcoats Gas Company have declared a dividend at the rate of 4½ per cent., and have raised the price of gas from 3s. 4d. to 3s. 9d. per 1000 cubic feet. At Castle Douglas, the Gas Company have paid a dividend at the rate of 7 per cent., and have added £100 to the reserve fund. The Directors have in contemplation an increase in the price of gas, which is at present 5s. 10d. per 1000 cubic feet for lighting, and 4s. 7d. for cooking and heating. The Stranraer Gas Company have increased the price of gas from 4s. 7d. to 5s. per 1000 cubic feet. The Crieff Gaslight Company have declared a dividend at the rate of 10 per cent., and have increased the price of gas from 4s. 2d. to 4s. 7d. per 1000 cubic feet. The Alyth Gas Company have paid a dividend at the rate of 4 per cent., and have increased the price of gas from 5s. 10d. to 6s. 3d. per 1000 cubic feet. The Newburgh (Fife) Gas Company are paying no dividend this year, but are devoting their profit to improvements on the works. They have raised the price of gas from 6s. 8d. to 7s. 1d. per 1000 cubic feet. The Anstruther and Cellardyke Gas Company have paid a dividend of 3 per cent. and a bonus of 2 per cent., and have raised the price of gas from 3s. 9d. to 4s. 2d. per 1000 cubic feet. The Elie Gas Company have paid a dividend at the rate of 3 per cent., and continued the price of gas at 6s. 6d. per 1000 cubic feet. The Crail Gas Company have raised the price of gas by 5d.—making it now 7s. 1d. per 1000 cubic feet. The Pittenweem Gas Company have paid a dividend at the rate of 10 per cent, and have raised the price of gas from 4s. 2d. to 4s. 7d. per 1000 cubic feet. The Leven (Fife) Gas Company have paid a dividend of 5 per cent., and have raised the price of gas from 3s. 4d. to 3s. 9d. per 1000 cubic feet.

The report by the Water Committee of the Corporation of Glasgow for the year ending May 31 last has just been issued. The rates assessed and levied last year were as follows: Domestic water-rate within the limits of compulsory supply, 5d. in the pound; and the public water-rates, within the said limits, 1d. in the pound. The domestic water-rate levied beyond the limits of compulsory supply was 10d. in the pound. The revenue for the year totalled £212,734. The expenditure, including annuities and interest, amounted to £172,753. Of the balance, £59,783 has been carried to the sinking fund, and £22,740 to next year's account. The income shows a decrease of £4010, and the expenditure an increase of £17,194 over the previous year.

The Dundee Town Council, on Thursday, considered the estimates for the year of their Water Department. Treasurer Ritchie said that the total estimated expenditure amounted to £49,535; being £715 in excess of last year's estimate, and £479 above the actual. The total revenue for the year was expected to amount to £49,722, leaving an estimated surplus of £187. It might be worth noting that the rate of 9d. they now proposed was exactly one-half of the domestic rate levied in 1869, when the water-works were taken over by the Commissioners, and which was also charged during the years 1881-83. The estimates were adopted.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 7.

Sulphate of Ammonia.—The week opened with a very quiet market; and sales were made at a decline on last week's prices. Later, a better tone supervened, induced by an improvement in the forward position; and the closing quotations are £10 12s. 6d. to £10 15s. per ton, delivered f.o.b. at the ports, though inquiry is mainly for later months. For July-September delivery, £10 15s. per ton f.o.b. Leith is quoted. But, so far, this price is not reported paid; while for October-March delivery, makers' quotations are £11 to £11 2s. 6d. per ton. Interest in this position is, however, mainly speculative. Consumers have not up to the present followed the advance.

Nitrate of Soda is firmer in all positions—spot, afloat, and for shipment f.o.b. Spot quotations are 8s. per cwt. for ordinary, and 8s. 3d. for fine quality.

LONDON, *July* 7.

Tar Products.—The value of fuel generally appears to be stiffening, contrary to expectations; and this reflects itself on the price of pitch. There are now important buyers for next season's delivery at to-day's quotations. Creosote is dull, and difficult to sell; and, in cases where makers have carried oil forward for summer delivery, disappointing prices are being obtained. A steady market exists for naphthalene in its several forms; and this somewhat relieves the strained position brought about by the neglected state of creosote. Carbolic acid is selling well, and

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is likely to be dearer. The position of benzols is difficult to define; and quotations vary in a very remarkable degree, and are evidently influenced first by quality, and next and more important by the position of delivery. A better outlet is developing for gas enrichment. Solvent naphtha is in a little more favour. The outlook for products generally, however, is not too promising.

Prices may be taken as follows: Tar, 17s. 6d. to 28s. Pitch, east coast, 37s.; west coast, 34s. Benzol, 90's, 7d. to 8d.; special qualities for gas, 9½d.; 50's, 10d. Toluol, 1s. 1d. Solvent naphtha, 1s. 1d. Crude naphtha, 3½d. Heavy naphtha, 1s. Creosote, 2¼d. Heavy oils, 3d. Carbolic acid, 50's, 2s. 1½d.; 60's, 2s. 7½d. Naphthalene, drained, 35s.; pressed, 75s. Anthracene, "A," 4d.; "B," 2d. to 3d.

Sulphate of Ammonia, after a rapid fall (touching the low price of £10 5s. in some instances), has quickly rebounded to about £10 10s., less 3½ per cent. To-day's position is undoubtedly better; but the market appears to be unhappily in the hands of speculative dealers. The higher price now ruling for nitrate of soda should have a beneficial effect upon sulphate.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The tendency of surrounding conditions is perhaps not quite so satisfactory as of late in the coal trade of this district. A noticeable feature is that engine classes of fuel, which until recently have held the strongest, now occupy the weakest, position in the market. Up to the present, this change has been brought about mainly by the large quantities of slack that have been coming forward from other districts, and which practically have taken one or two outside markets out of the hands of Lancashire collieries. A further depressing influence is the outlook in the cotton trade, which is not nearly so good as a short time back; while the serious situation in China is more than likely to still further considerably restrict business in this staple branch of Lancashire industry. Already short time is being very generally talked of in the cotton trade; and if there were to be any large stoppage of production at the mills, this would necessarily restrict to a corresponding extent the requirements for engine classes of fuel. Lancashire collieries are still experiencing no great difficulty in moving away their present production of slack; and it is exceptional where anything like stocks are accumulating. They are consequently holding on to the basis of quoted rates, representing about 10s. to 10s. 6d. per ton at the pit for common slack, up to 11s. and 11s. 6d. for the best descriptions. They are, however, being undersold 1s. per ton by slack coming in from Derbyshire, Staffordshire, Nottinghamshire, and South Yorkshire; and it would seem very questionable whether full prices in Lancashire can be much longer maintained. All descriptions of round coal are still moving off exceptionally well for the time of the year. Even in the better qualities no stocks of any weight are as yet accumulating; but the output is steadily more and more overlapping requirements. The lower qualities continue in fairly good demand for steam and forge purposes; while an active inquiry for shipment is taking away any surplus supplies that collieries may chance to have, at even better prices than can be secured on inland sales. The quoted pit prices remain very much the same as for some time past—ranging from about 12s. 3d. to 12s. 6d. per ton for ordinary steam and forge coals, to about 13s. and 13s. 6d. for common house-fire descriptions, up to 14s. 6d. and 15s. 6d. for the best qualities of house coal. There is, however, one feature in the market which scarcely augurs satisfactorily for the future. Although collieries were successful in forcing their prices on forward contracts with the railway companies and for gas coal, they are still sellers in the market for current requirements at quite 6d. per ton less than the contract rates; and under such circumstances, it is only natural that users of coal are very chary about contracting, and in most cases prefer to go on with deliveries from hand to mouth. For shipment, prices are steady at about 14s. 3d. to 14s. 6d. per ton at the pit for unscreened, and 15s. 3d. to 15s. 6d. for good screened steam coal. There is still a brisk demand for coke; but prices are not more than maintained at 24s. per ton for furnace, and 31s. to 32s. for foundry sorts at the ovens.

Northern Coal Trade.—There is renewed activity in the coal trade of this district; and prices are, on the whole, firmer. But the output is adequate for all requirements. Best Northumbrian steam coals are from 17s. 6d. to 17s. 9d. per ton f.o.b., and steam smalls are from 12s. 6d. to 12s. 9d. There have been some heavy inquiries for this class of fuel, which have stiffened the market. In the gas coal trade, deliveries are now on the new contracts; but they are of about the usual summer extent. Output is fairly good, and exports are well maintained, so that the production is readily taken up. For occasional cargoes, the price is quoted at 16s. 6d. to 17s. per ton f.o.b. for best Durham gas coals; but the sales are not heavy. Local gas companies are taking only limited supplies at present. In the coke trade, there is a strong demand both for home use and for export; so that prices are firm, as quoted by us last week. In gas coke, there is now a limited production, and higher prices are generally asked—indeed, as high as £1 per ton has been quoted this week. This is a price for gas coke that has not been locally known for many years; but it is believed that only limited lots are being taken at that figure.

Scotch Coal Trade.—There is a good demand for all classes of coal. The holidays are now on; and, as a consequence, the output is somewhat less. The trouble in China is already being looked to as a possible cause of large demands for ironwork; and, if so, there will be no fall in the price of coal, but probably a further rise. Prices show little variation. The quotations are: Main 14s. 6d. to 14s. 9d. per ton f.o.b. Glasgow, ell 16s. to 17s., and splint 16s. to 16s. 6d. The shipments for the week amounted to 233,615 tons—a decrease of 26,997 tons upon the previous week, but an increase of 22,847 tons upon the corresponding week last year. For the year to date, total shipments have been 5,259,458 tons—an increase of 1,061,731 tons over the corresponding period last year.

Many of the new contracts for gas coal, entered on a month or two ago, commenced on Monday last week. The "Newcastle Chronicle" says the basis of the prices will be about 16s. per ton, free on board—a price that

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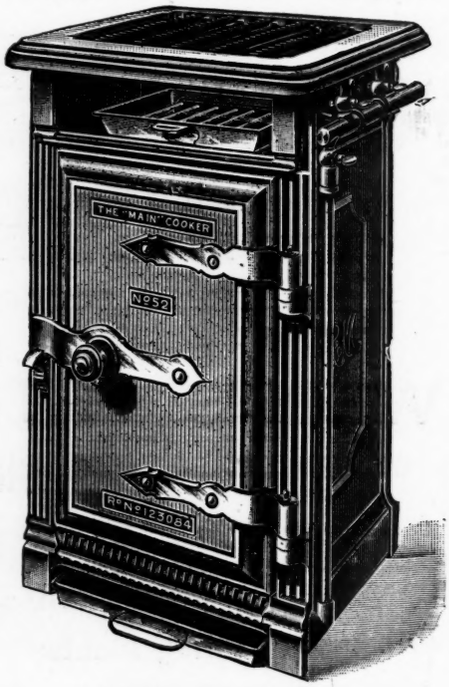

Prices from 25s. to 80s.

may be taken as showing an advance on that under the contracts which have just expired of 75 per cent. in many cases. Contrasting this with a period a little farther back, a still more marked advance is seen. Five years ago, contracts were entered into for coal delivered at Rotterdam at 10s. 3d. per ton, or possibly 5s. 9d. per ton, free on board. The advance, therefore, to the rate above quoted is enormous. Our contemporary thinks that it is doubtful whether the high prices of to-day will endure for very long.

Additional Capital for the Coventry Gas Undertaking.—The most important business at the meeting of the Coventry Town Council last Tuesday was a report of the Estates and Finance Committee in regard to the creation of stock, amounting to £254,875. The largest item is for gas purposes—£113,203. During the consideration of the matter, Alderman Andrews raised a question as to regularity; pointing out that neither the Gas Committee nor the Council had sanctioned the raising of so large a sum. This was admitted; but the Town Clerk explained that part of the money—about £30,000—was owing by the gas undertaking, and had to be paid off, while the remainder was the estimated cost of new works to be executed during this or next year. No authority was sought to raise the money, but merely to obtain an Order from the Local Government Board for power to raise it should the Council think fit. Time was an object; if application were not made now there could be no issue till next October. Alderman Andrews was unconvinced, and moved an amendment delaying the matter for a fortnight. For this only seven of the members voted; and the recommendation of the Committee was adopted.

Gas Profits at Bury.—Upon the minutes of the Gas Committee being presented for confirmation at the meeting of the Bury Town Council last Thursday, Mr. Sykes raised an objection to the allocation of the profits made by the gas-works last year, and pointed out that some years ago they threshed out the question of large profits, and decided that in future they should be as bare as possible, and that the gas should be sold as near as it could be to cost price. He protested against the thin edge of the wedge of large profits being introduced, and after pointing out that nearly £2000 of the profits went in reduction of rates, asserted that, in fairness, it ought to have gone back to the consumers. The Mayor (Mr. J. Byrom), who is Chairman of the Gas Committee, said he agreed with Mr. Sykes that large profits should not be made; and the Gas Committee had endeavoured to sell the gas at as near cost price as possible, subject to contingencies and the maintenance of the works. The reason for the profit was set forth in the minutes of the Finance Committee. They had made a substantial working profit; but in addition there was a contribution of £2000 made on behalf of a colliery company for supplying inferior coal, and also a reduction in the repayment of sinking fund. They could not, however, expect so large a profit next year. They had entered into contracts for the supply of coal for the current year at prices averaging 5s. per ton more than they paid last year; and from what the Committee could see, they did not expect to make more than £2000 profit this year, and it might be less. The minutes were confirmed.

East Surrey Water Company.—The annual general meeting of this Company was held on the 30th ult., at the offices, Redhill—Sir Myles Fenton, J.P., presiding. In their report, the Directors stated that there had been 758 additional customers in the twelve months ending the 25th of March. The profit for the year had been £18,376, which, with the balance of £1354 brought forward, made £19,730, out of which they had placed £1500 to the renewal and contingency fund. They recommended that the dividend of 5 per cent. upon the preference shares, and a dividend of 7 per cent. upon the ordinary shares (less income-tax in both cases), should be declared for the year. An interim dividend, however, of 2½ per cent. on the preference and of 3½ per cent. upon the ordinary shares, disposing of £5471, having been paid on the 6th of December last, there would remain to be paid 2½ and 3½ per cent. respectively, absorbing £6148, and leaving a balance of £1737 to be carried forward. The report was adopted. At a special meeting held after the close of the ordinary business, the Directors were authorized to issue by tender 600 ordinary shares of £10 each; and the number of the Board was increased to seven.

Sales of Shares.—Last Tuesday week, Messrs. William Bush and Son sold by order of the Directors of the Sheffield United Gaslight Company, £955 class "B" stock, £1030 class "C" stock, and 1875 class "F" shares of £3 each fully paid. The first-named stock realized from £243 10s. to £246 per cent. Of the class "C" stock, £1000 made £240 per cent., and £30 £242 5s. per cent. The 1875 class "F" shares were sold in small lots. Of these, 530 were sold at £7 5s. each, 1105 at £7 3s. 9d. each, and 240 at £7 2s. 6d. each. The same day, Messrs. Hollis and Webb sold some shares in the Aberford Gas Company at £2 7s. 6d. each. Some £10 shares in the Wellington (Salop) Gas Company have recently changed hands at £27 15s. and £28. At the Mart on the 29th ult., Mr. Alfred Richards sold various parcels of gas and water stocks and shares. The first lots consisted of some 4 per cent. perpetual debenture stock of the Southend Water Company, put up by order of the Directors, and it all sold well at from £114 to £115 per £100. Five £10 fully-paid original shares in the West Kent Gas Company (last dividend 10 per cent.) fetched £20 each; five others realizing 5s. more apiece. Some £10 "D" water shares (£4 paid), on which the last dividend was at the rate of £6 6s. per cent. per annum, were sold for £7 10s. each; an allotment of 13 similar shares on which the first call had to be paid fetching, curiously enough, £4 10s. apiece. A parcel of £5 shares in the Horley District Gas Company, Limited, ranking for a 10 per cent. dividend, but the last being at the rate of 3½ per cent. per annum, was sold for £4 2s. 6d. and £4 5s. per share. The final lots, consisting of a few fully-paid additional £10 "C" shares in the Harrow and Stanmore Gas Company (last dividend £5 12s. per cent. per annum), were sold for £11 12s. 6d. each. At Arundel last Thursday, Mr. George Sparks offered for sale £1000 of consolidated ordinary stock of the Arundel Gas Company. The standard dividend is 5 per cent. per annum, subject to the sliding-scale, and the conditions of sale stated that the stock would rank for dividend as from the 1st inst. It was offered in £10 lots, and the prices realized ranged from £11 to £11 4s.; the bulk going at £11 2s.

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Buckley District Council and the Gas-Works.—In reply to an inquiry, the Buckley Gas Company have informed the Local Authority that they are willing to sell their undertaking for £4750. The Council are trying to obtain a modification of this price.

Gainsborough's Artesian Wells.—The second boring for an artesian well to supply Gainsborough with water has been completed; and a plentiful supply of pure water has been tapped at a depth of 1508 feet. Application has already been made to the Local Government Board for sanction to a loan of £8400 to cover the cost of pumping machinery; but as the circumstances at Gainsborough are peculiarly favourable, it is proposed to give special attention to the American system of lifting the water by means of compressed air. Mr. Percy Griffith, the Engineer, has written to the Council advocating this course. He pointed to the low cost of machinery, and the entire absence of friction, and said the system ensured a steady flow of water. A Committee was appointed to visit Hampton to view the compressed-air system in operation.

Cleanliness and Water Supply.—The question of water supply to large centres of population is likely to be complicated by considerations which, according to the "Lancet," did not obtain in such force half-a-century ago. Speaking of the 75 million gallons of water per diem which will soon be available for Manchester, the "Lancet" says that, with the increasing growth of habits of personal cleanliness which are gradually permeating through the population from above downwards, there is a much greater demand for water for domestic purposes, including the supply for baths, which are now common in Manchester in small "weekly" houses, as they are called, than would have been dreamt of fifty years ago. The Water Committee, it seems, have come to the opinion that, at the rate of increase for the last ten years, and allowing for the growth of the population, "the whole 75 million gallons per day is likely to be overtaken in about 35 years."

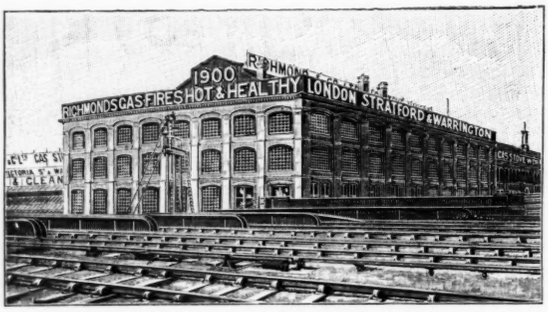
Water-Works Extensions at Bath.—Included in the minutes which the Water Committee submitted at the meeting of the Bath City Council last Tuesday were proposals by the Water Engineer (Mr. C. Gilby) with reference to increasing the supply. Mr. Henshaw, in moving the adoption of the report, said a recommendation of further outlay should not be viewed with any regret, for it was an expenditure necessary in consequence of increasing business. In support of this contention, he mentioned that in 1890 the gross receipts were £12,000; and in 1900 they were £15,000. The profits ten years ago were £1383; for the year ended March last they were £3068. Four or five conclusions at the end of Mr. Gilby's report practically summed up the whole situation. He said that an extension should be made sufficient to supply 80,000 persons. The population at present served was 68,100; in 1877, it was 48,000. Even from 1898 to the date of the report, there was an increase of 1500 persons. A point which had given rise to discussion in Committee was Mr. Gilby's recommendation that a supply of 24 gallons per head per day should be provided. During 1899 it averaged 21·86 gallons, which compared very favourably with other towns. The report was carried, with an addition that any scheme for increasing the supply should include a supply to every part of the borough, including the higher levels.

The Water Supply of Johannesburg.—The Directors of the Johannesburg Water-Works Estate and Exploration Company, Limited, report that a cablegram has been received, as follows: "Water-works supplying all water required. All men well. Company's property intact."

Dear Coal but no Advance in Price of Gas.—At the last monthly meeting of the Barrow Town Council, the Gas and Water Committee recommended the acceptance of new coal contracts for the ensuing year, which represented an advance of 5s. per ton on those of last year. This, Alderman Strongitharm explained, would entail a loss on the department of about £4500, unless they made more profits by increased consumption or improved value of residual products. The Committee, however, did not propose to increase the cost of gas. The Dukinfield Gas Committee have purchased a quantity of coal at 16s. 9d., 17s. 6d., and 17s. 9d. per ton, which is an increase of 5s. to 6s. per ton on the previous contracts. Notwithstanding, they expect to get through the year without advancing the price of gas.

Projected Extension of the Carlisle Gas-Works.—The Gas Committee of the Carlisle Corporation considered, at their meeting last Thursday, the question of extending the plant at the gas-works, so as to cope with the increasing demand for gas in the city. The Gas and Water Engineer (Mr. C. B. Newton) submitted two estimates—one for plant to make 600,000 cubic feet of carburetted water gas, and another for plant for making an equal quantity of coal gas, per day. The estimate for the former was £14,732; and that for the latter £13,185—a difference in favour of the coal-gas plant of £1547. The deputation who visited other towns to see carburetted water-gas plant in operation were practically unanimous in recommending its adoption in Carlisle; but the vote resulted in favour of the extension of the coal-gas plant. A recommendation in accordance with this decision will therefore be laid before the Council.

The Second Pipe-Line from Thirlmere.—The Water Committee of the Manchester City Council last Thursday appointed Mr. George H. Hill Consulting and Advising Engineer for the new work of laying the second pipe from Thirlmere to Manchester, and Mr. M. R. Barnett, who was engaged upon the original Thirlmere works under Mr. Hill, was appointed to act as Engineer for the new undertaking. The Engineers were instructed to prepare the necessary specifications and conditions of contract for the pipes that will be required, and also to present a report as to the method to be adopted for carrying out the work with a view to obtaining tenders for the pipes that will be required. The exact class of pipes to be used in certain places will have to be further considered. It is, for instance, suggested that across the bridges *en route* steel tubes shall be adopted as being lighter than iron ones. Finding that there is some difficulty in drawing a full 10 million gallons daily through the 40-inch pipe now in operation, it is regarded as possible that the new duct may be 42 inches or even 44 inches wide, seeing that the arrangements in connection with the wells and tunnels will allow this change, and that probably little, if any, difficulty would be occasioned thereby along the line from the city to the lake. These matters will be dealt with in the report by the officials.



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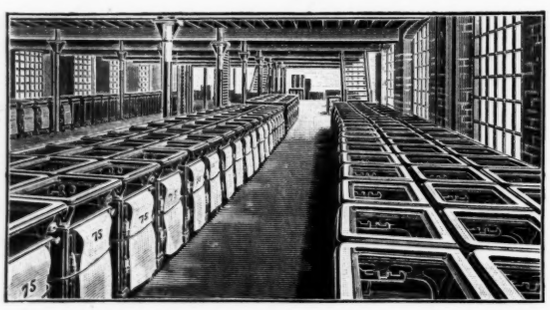

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"Fetch forth the stocks, ho!"—Lear II., 2.

Water Charges in Rochdale—Now that water is not so plentiful in Rochdale as formerly, the Town Council, on the recommendation of the Water Committee, have decided to revise the charges for manufacturing purposes. The Oldham scale (ranging from 19·5d. to 10·54d. per 1000 gallons) is to be adopted for quantities not exceeding a million gallons per quarter; but above that quantity a uniform rate of 8d. per 1000 gallons is to be adopted.

Gas and Electric Lighting Affairs at Belfast.—By 22 votes to 15, the County Borough Council of Belfast yesterday week decided to amalgamate the Gas and Electric Lighting Committees. In a report presented by the Gas Committee, it was shown that a resolution had been passed to the effect that persons having on their premises meters larger than their consumption of gas required, must either consent to the substitution of smaller meters, or be charged a rental in respect of the large meters retained. The report also dealt with a grievance which had been laid before the Committee by a deputation of the men employed at the works. It had been alleged that there had been a practice of giving men employment at the gas-works in the alphabetical order of their names. But this was denied by the Assistant Manager (Mr. Sharpe), who stated that the course pursued was to select the best men offering themselves, and to give preference to such as had been longest on the works, and whose conduct had given satisfaction. The Committee reported that they saw no reason to alter this practice. These matters produced some discussion; but the report was passed, with the exception of the following resolution, which was referred back until the accounts were in the hands of the Council: "That owing to the great increase to be incurred this year in working expenses, in consequence of the increased cost of coal and oil, the Council be recommended to carry forward the entire profits, £32,597 12s. 2d., to next account."

The Newcastle-on-Tyne Corporation and the Price of Gas.—The Newcastle Corporation have a good system of keeping themselves in touch with all that concerns the gas and water supply of the city; and, when they require any explanations, they go direct to headquarters in a friendly way, obtain what they require, and publish the result for the benefit of the consumers. The effect is good for all parties. When the Directors of the Gas Company recently decided to increase the price of gas by 4d. per 1000 cubic feet, a Committee was deputed by the Council to look into the matter. The consequence was that they reported at last Wednesday's meeting that, owing to the cost of coal having increased 7s. per ton, and the price of materials and wages having enhanced, it was absolutely necessary to increase the price of gas. Speaking upon the report, Mr. Sutherland added that the extra cost of coal would amount during the year to £86,000; the extra cost of other materials would be £6000; and the extra cost in wages would be £1800. Against these increases, the Gas Company would receive, from the additional value of coke, £44,442; but the increased cost would still be £49,887. An increase of 4d. per 1000 cubic feet in the price of gas would yield £35,252. The Gas Company had a reserve balance of £7827, and would relinquish, in diminished dividends, above £6000. These three figures would make up the £49,000 deficiency. It was agreed that the report should be printed and circulated.

Explosions of Gasoline and Oil Tanks.—According to a Reuter's telegram sent from New York last Wednesday, an engine on the Ohio River Railway ran into a gasoline tank in the station yard at Pardersburg, owing to a switch having been left open, and caused it and several other tanks to explode. Six men are reported to have been killed and 25 injured. The same evening, according to another Reuter telegram, a portion of the Standard Oil-Works at Bayonne (N.J.) was destroyed by fire, due to lightning. About 20 tanks, each containing 30,000 gallons of oil, exploded, and the burning oil flowed into the harbour. Plant extending over 500 acres was destroyed; the loss being estimated at about £500,000.

Checking Waste of Water at Epsom.—At the last meeting of the Epsom Urban District Council, it transpired that Mr. Graham, their Consulting Engineer, had reported to the Water Committee that since the water-works were placed in his hands on the 24th of May no difficulty had been experienced in providing an adequate supply of water, or in keeping the reservoirs full. By far the larger portion of the water raised had been obtained from the old borehole, and there was no reason at present to apprehend any failure of this source. On the night of the 12th of June, he caused the water to be left on throughout the district, and the loss from the new reservoir between twelve and one o'clock was 16,800 gallons. On the night of the 21st of October last year, for the same period the loss was 29,120 gallons. Thus the waste-prevention work which had been done has resulted in a saving of 12,320 gallons per hour. There still remains a great deal to be done; the waste at present going on being something like 400,000 gallons per day if the town was on constant supply, or 20 hours' pumping of the horizontal engine. The work of waste prevention was being vigorously carried on. Mr. Graham had every confidence that in a short time the whole town would be in the enjoyment of a constant supply of water.

New Water-Works for Earlestown and Newton.—The new water scheme, which has been under the consideration of the Earlestown District Council for the past five years, and which some few months back was ultimately resolved upon, has now assumed a practical shape; and the first of the three sections into which the scheme was divided is rapidly approaching completion. The selection of the site for the new works was made by Mr. G. H. Hill, and Mr. D. M. F. Gaskin, Consulting Engineer to the Water Committee of the District Council. Two boreholes have been made, 100 feet apart; and the water will be raised by two 13-inch pumps of 4-feet stroke, actuated by a horizontal single-condensing engine, with helical gearing. The water will be discharged into a covered concrete tank, capable of holding 200,000 gallons, or a day's supply. From this tank the water will be raised by a pair of double-acting horizontal pumps, and discharged direct into the mains. These pumps, quadruple acting in effect, will be governed by the water pressure in the mains; so that the force pumps will automatically adjust themselves to the varying requirements, night and day. Mains, 8 inches in diameter, will be laid from the works to join the old mains at Newton Bridge. The work was designed and carried out under the supervision of Mr. D. H. Lloyd, the Gas and Water Engineer to the Council. The first section will cost about £6000; and the estimated cost of the whole scheme is £23,000.

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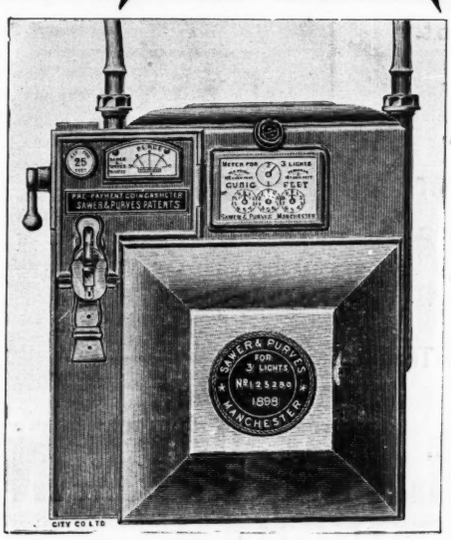
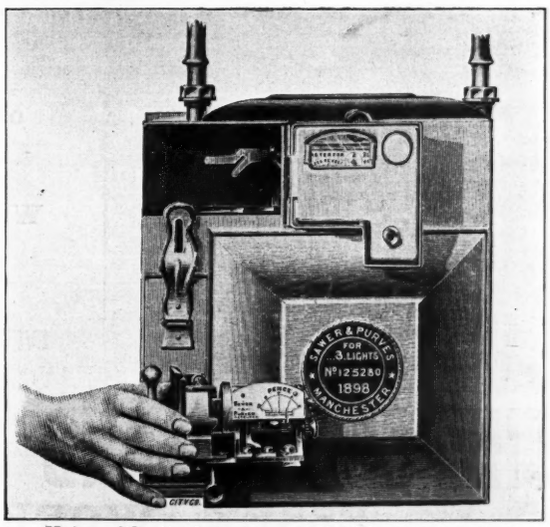


Meter in working position.



Meter with attachment removed without uncoupling.

The East London Company's Charge for Sewer-Flushing Water.—After the decision of the Magistrate at the North London Police Court, on the 5th of May last, determining the rate which should be charged by the East London Water Company for water supplied for road watering as 6d. per 1000 gallons, the Surveyor of the Hackney Vestry has been in communication with them as to whether the water supplied for the flushing of sewers and drains, for which the Vestry have hitherto paid at the rate of 9d. per 1000 gallons, should not also in future be charged for at the lower figure. The General Purposes Committee have reported that the Company have agreed to this reduction.

Transfer of the Morecambe Gas Undertaking.—Last Sunday week was the day originally fixed in the agreement between the District Council and the Morecambe Gas Company for the transfer of the gas undertaking to the former. The Council, however, have not yet completed their arrangements for borrowing the purchase money, and so are not in a position for immediately carrying out their bargain. The Council expect to raise the necessary £150,000 or £160,000 in the open market as soon as the conditions are favourable, after which the Company will be promptly expropriated. In the meantime the existing Directors, which include Mr. Baxter (Chairman of the Gas Parliamentary Committee), and Mr. J. Gardner (Chairman of the Council), will continue to administer the undertaking on behalf of the purchasers.

Swansea Prepayment Consumers' "Contracts."—The following paragraph is taken from the "South Wales Daily News:" The Swansea Gas Company, who are engaged in having the penny-in-the-slot meters altered so as to make the supply of gas per penny in proportion to the increased price being imposed, find that the action is being resented. All the customers have a contract with the Company; and they maintain that this must be terminated before the meters can be altered. Hence in many of the houses the alterations have only been allowed under protest; while in some the officials have been refused access to the meters. Thereupon the Gas Company have served upon the customers a notice threatening that, unless they permit an inspector to enter their premises, and alter the discs to the increased rate of 6d. per 1000 feet, the supply to their premises will be discontinued, and the meters removed within 24 hours. It is intended to resist the removal.

The Increased Price of Gas in London.—A conference was held at the offices of the Limehouse District Board of Works last Wednesday, to consider what action should be taken in regard to the decision of the Commercial Gas Company to adhere to their increase in the charge for gas by 6d. per 1000 cubic feet. There was a good attendance of delegates—the Limehouse, Poplar, and Whitechapel District Boards, and the Vestries of Mile End, St. George's-in-the-East, Bow, and Bethnal Green being represented. It having been stated that Counsel's opinion had been obtained, to the effect that the notice of the Company to raise their charge for public lighting was illegal, on the ground that it was issued in the middle of a quarter and could not be retrospective in action, it was decided to bring a test case against the Company, with the view to ascertaining whether the private consumer did not stand on the same basis as a public body. The Home Secretary will, it is understood, be memorialized on the matter. The Islington Vestry are taking steps to invite the Vestries north of the Thames to a conference "to discuss the advisability of taking some action to bring about a revision of the present high and unjustifiable rates for gas."

The salary of the Gas Engineer to the Colne Corporation (Mr. F. Thorpe) has been increased by £75 per annum.

Messrs. John Wright and Co., Limited, of Birmingham, held an exhibition of gas appliances at Chester last week, having as cookery demonstrator Miss Mary Ball.

The New Conveyor Company have issued a writ against the Brighouse Corporation for an alleged infringement of their patent by the erection of inclined retorts at the gas-works.

The Hull Corporation Water and Gas Committee have accepted the tender of the Staveley Iron Company for the supply of cast-iron water-pipes, in 12-feet lengths, at £6 17s. 6d. per ton.

The Keady (Ireland) Gas Company have been established 48 years; and during that time the shareholders have only been troubled with one dividend, and that was at the rate of 3 per cent.

It was stated at the meeting of the West Bromwich Town Council last Wednesday, that the estimated increased expenditure in the Gas Department in the current year would be about £7000.

Mr. James Head, of No. 40, Lowndes Square, S.W., and Mr. Herbert Praed, of No. 29, St. James's Place, S.W., have joined the Board of the Welsbach Incandescent Gas-Light Company, Limited.

An extraordinary suicide is reported from Abingdon. A gas-fitter named Joseph Bryant entered the garret of an unfinished house, and having cut a gas-pipe, stretched himself over it until he was suffocated.

Mr. Edward Brook, of Meltham, and of Hoddom Castle, N.B., has given to the Meltham Urban District Council land for an additional reservoir, and all rights for tapping and securing the springs on the higher ground. This will enable the Council to increase the water supply, which is much needed in dry seasons.

As will be seen by an announcement which appears elsewhere, the New River Company are inviting tenders for an issue of £200,000 of 3 per cent. "D" debenture stock, redeemable in 25 years. The stock, which is a trustee investment, is the first portion of the £1,000,000 of this stock authorized by the Company's Act of 1897. It is issued subject to a reserve price, and tenders will be received up to the 19th inst.

At the Middlesbrough Police Court on the 29th ult., Messrs. G., P. C., and W. C. Lambert, of Middlesbrough, were fined £5 and costs for unlawfully selling gas economizers to which a false trade description—viz., "Bray's Codac Gas Economizers"—had been applied. Messrs. George Bray and Co., of Leeds, send out their burners on cards bearing their name, and an intimation that no others are to be placed thereon under penalty of legal proceedings. One cards purchased at Messrs. Lambert's shop by Mr. H. Mudd, Messrs. Bray's Commercial Manager, contained 36 burners, 23 of which were not those supplied by the firm.

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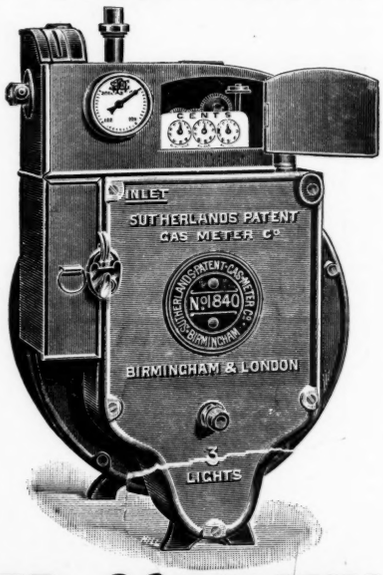

THE SUTHERLAND GAS-METER COMPANY
ESSEX WORKS, BIRMINGHAM.

The employees of Messrs. Richmond and Co., Limited, and some friends had their annual excursion on the 30th ult. The party, numbering considerably more than 1000, were conveyed by three special trains to Liverpool, and thence by steamship to Douglas (Isle of Man), where they were met by Mr. Richmond, and cordially welcomed. At his invitation, the heads of the various departments and several friends drove to Port Erin, and dined at the Belle Vue Hotel. In the course of the after-dinner proceedings, Mr. Richmond stated that though they had a large increase in the business at Warrington last year, there was a still greater one at Stratford. This year, however, Warrington had established the record; the business to the end of May having shown an increase of 58½ per cent. over 1899. He looked forward to achieving still better results. The party returned to Douglas shortly after five.

The thirteenth annual dinner of the employees of the Welsbach Incandescent Gaslight Company, Limited, was held at the Terrace Hotel, Margate, on Saturday, the 30th ult. The company, to the number of about 200, left Victoria early by special train, and arrived at Margate by 10.30. Dinner was served at 1.30, under the presidency of Mr. W. Divine; Mr. J. Bartlett occupying the vice-chair. The toast of the day—"The Welsbach Incandescent Gaslight Company, Limited"—was very cordially received, and was responded to by Mr. S. How. In the course of his remarks, he mentioned that the Managing-Director, the Directors, and the Commercial Manager had each subscribed towards the expenses, in addition to the Company's usual contribution. Other toasts followed. In the afternoon, the surroundings of Margate were visited; and at 5.30 tea was provided. The party returned by special train at 8.15. The outing was very successfully carried out by the stewards (Messrs. Bellis, Collings, Lowe, and Stone); the only regrettable feature being the absence of the Hon. Treasurer (Mr. F. H. Ferguson) through illness.

A few months ago, when the period of dear coal set in, the Managers of the "Sheffield Telegraph" had their attention drawn to the advantages to be derived from the utilization of breeze for steam-raising purposes; the cost being shown by Mr. Bryan Donkin to be 3s. 8d. per 1000 gallons of water evaporated, as compared with 5s. 3d. for Welsh coal dust and 10s. 11d. for large coal of this class. As they found that the Sheffield Gas Company were giving away, to builders and others, considerable quantities of breeze, they entered into a contract with them for a supply for three years; and having a spare boiler, they had fitted to it the forced draught appliance of Messrs. Meldrum Bros., Limited, of Manchester, and found that with it coke dust made a very satisfactory fuel for their purposes. They then had their second boiler fitted with the arrangement; and the two are now burning the coke dust almost exclusively. The economical results of the change will be apparent when it is stated that the average weekly cost of one boiler with coal only was £28 16s. 6d.; whereas the cost with coal and coke dust fuel, for two boilers, is £10 5s. 6d.—a saving of £18 11s.—with the additional advantage of the abolition of smoke from the chimney.

The employees of Messrs. Willey and Co., of Exeter, with their wives and friends, had their annual outing on the 30th ult., when, as guests of the firm, they were taken to Cardiff, *viâ* Weston-super-Mare, and entertained at the Park Hall. The chair was occupied by Mr. H. A. Willey; Mr. Sidney Willey being in the vice-chair. After dinner, Mr. Edwards proposed "Prosperity to the Firm;" and the toast was enthusiastically received, with musical honours. Mr. Willey responded in an interesting speech, in which he dwelt on the blessings of peace, the advantages to be derived by the working classes from the establishment of day technical schools, and the union of the interests of capital and labour by making every workman a sharer in the profits realized in the industry with which he is associated. He asked those present to drink to the health of the employees—"the backbone of the firm, whose integrity, fidelity, and hard work he cheerfully recognized." A pleasing incident of the day's proceedings was the presentation to Mr. and Mrs. Willey of a silver fruit-stand, subscribed for by the men, their wives, and the lads employed at the works, as a slight testimony of their appreciation of the many kindnesses they had received. Mr. Willey, in acknowledging the gift, assured the donors that he was very much touched by the sympathy and kindly feeling which had prompted it, and that he should appreciate it as long as life lasted. The fruit-stand bore the following inscription: "Presented to Mr. and Mrs. H. A. Willey as a tribute of sincere respect and good feeling by the employees of Messrs. Willey and Co. and their wives, on the occasion of the annual outing of the firm, 30th June, 1900." On the reverse side was Mr. Willey's crest. The large party (about 800 in all) reached Exeter at 10.30 after a most enjoyable day's outing, for the generous provision of which the gratitude of those participating in it was freely expressed.

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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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[For Illustrated Advertisement, see July 3, p. 53.]

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CORNISH BOILER, 4 ft. diameter, by 12 ft. long.

Apply to SAML. WHILE AND SON, 60, Queen Victoria Street, LONDON, E.C.

FOR SALE—Five splendid Tanks, about 7 feet in diameter, 25 feet deep, Wrought-Iron. Twenty Pounds each, f.o.r. Exeter. Useful on Gas-Works for Tar, Ammoniacal Liquor, Scrubber, &c. Subject unsold, net cash.

Apply WILLEY AND CO., Engineers, EXETER.

FOR SALE—Two Lancashire Boilers, each 6 ft. diameter by 20 ft. long, with Mountings. Been in use only a short time. Made by the Yorkshire Engine Company, Limited, Sheffield.

Apply to NEWTON, CHAMBERS, & CO., LIMITED, Thorncliffe Iron-Works, near SHEFFIELD, where the Boilers may be seen.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

CONDENSERS, Washer-Scrubbers, "Cutler" patent CONDENSERS (14) 6 in. to 12 in. PIPE CONDENSERS, Patent WASHERS by "Livesey," "Holmes," and "Cockey," EXHAUSTERS up to 60,000 Cubic Feet per hour. ENGINES, BOILERS, &c. Several TOWER SCRUBBERS, PURIFIERS, METERS, GOVERNORS, PUMPS, TANKS, VALVES, &c.

J. FIRTH BLAKELEY AND CO., Gas Engineers, DEWSBURY.

HENLEY-IN-ARDEN GAS COMPANY, LIMITED.

THE Directors invite Tenders for the supply of GAS COAL for their requirements during the Year ending June 30, 1901.

Tenders to be in my hands by noon, July 18 inst.

JNO. W. LORD,
Secretary.

TO COLLIERY PROPRIETORS.

THE Corporation of Haverfordwest in-vite TENDERS for the supply of about 1600 Tons of Double Screened GAS COAL, of the very best quality, to be delivered either at the Haverfordwest Railway Station, or at the Gas-Works Quay, Haverfordwest (by Water communication), in quantities as required by the Gas Manager during the Year commencing on the 24th of July, 1900.

Tenders by Friday, the 13th of July, 1900.

Forms and further Particulars of

R. T. P. WILLIAMS,
Town Clerk.

Council Chamber, Haverfordwest,
June 26, 1900.

OSWALDTWISTLE URBAN DISTRICT COUNCIL.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at the Church Gas-Works for One Year from the 31st day of July inst.

The quantity of Coal Carbonized is about 3700 Tons per annum.

Further Particulars may be obtained on application to the Manager, Mr. T. Loxley, at the Gas-Works, Church, near Accrington.

Endorsed Tenders to be sent to me not later than noon of Monday, the 30th inst.

No Forms of Tender issued.

B. T. WESTWELL,
Solicitor,
Clerk to the Council.

Town Hall, Oswaldtwistle,
near Accrington, July 2, 1900.

HORLEY DISTRICT GAS COMPANY, LIMITED.

THE Directors of the above Company are prepared to receive TENDERS from competent Firms for the carting and laying of about 10,000 Yards of CAST-IRON GAS-MAINS, from Lowfield Heath, Surrey.

The Pipes will be delivered at Crawley and Three Bridges Railway Stations.

Specification and Plans may be seen at the Office of the Company, 147, Dashwood House, New Broad Street, E.C.; at Mr. G. H. Robus' Office, 20, Bucklersbury, London, E.C.; and at the Works, Horley, Surrey.

Tenders, sealed and endorsed on outside "Tender for Mainlaying," and addressed to Henry Webber, Esq., Chairman, Horley District Gas Company, Limited, 147, Dashwood House, London, E.C., on or before Twelve noon, on July 17, 1900.

The Directors do not bind themselves to accept the lowest or any Tender.

R. SANDELL,
Secretary.

COUNTY BOROUGH OF HALIFAX.

THE Corporation of Halifax are pre-pared to receive TENDERS for the supply of OIL suitable for the manufacture of Carburetted Water Gas.

The quantity required is (*a*) 100,000 gallons for prompt delivery, and (*b*) 500,000 gallons during the Year ending the 1st of October, 1901.

Offers must be made for each lot separately, and Reference must be given as to where similar Oil has been in use, and to what extent.

Full Particulars may be obtained on application to Mr. Thomas Holgate, M.Inst.C.E., Engineer, Gas-Works, Halifax.

Tenders, endorsed "Oil," must be sent to the undersigned not later than Ten o'clock a.m., on Wednesday, the 25th of July, 1900.

The person whose Tender is accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

KNARESBOROUGH URBAN DISTRICT COUNCIL.

THE above Council are prepared to re-ceive TENDERS for the supply and delivery, for the Twelve Months commencing Sept. 1, of about 1800 Tons of screened GAS COAL, in monthly quantities as required.

They are also prepared to receive OFFERS for the purchase of the TAR and AMMONIACAL LIQUOR made at the above Council's Works during the same period.

Tenders to be in by the 21st of July, addressed to

T. MAINMAN,
Clerk to the Council.

July 5, 1900.

CITY OF RIPON.

THE Corporation invite Tenders for the supply of 3000 Tons of GAS COALS, to be delivered at their Gas-Works between the 1st of September, 1900, and the 1st of June, 1901.

For further Particulars, apply to the Manager, Gas-Works, Ripon.

Tenders, enclosing Analyses of the Coals offered, are to be sent in to me, on or before Wednesday, the 25th of July inst.

The acceptance of the lowest or of any Tender is not guaranteed.

By order,
M. KIRKLEY,
Town Clerk.

Town Hall, Ripon,
July 7, 1900.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of LIME, TUBES and FITTINGS, and SULPHURIC ACID.

Specification and Form of Tender may be obtained from Mr. W. Whatmough, Gas Manager.

Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of Work for which the Tender is sent in.

Sealed and endorsed Tenders to be sent to me not later than Tuesday, July 17, 1900.

By order,
J. H. BALDWICK,
Town Clerk.

Municipal Buildings, Heywood,
June 20, 1900.

GLASGOW CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR METERS.

THE Corporation invite Tenders for the supply of such METERS as may be required by them for Twelve Months from date of acceptance.

Forms of Tender may be obtained on application to Mr. Foulis, the Manager, at the Gas Office, 45, John Street, Glasgow; and sealed offers, marked "Tender for Gas-Meters," addressed to the Subscriber, will be received by him on or before Tuesday, the 17th prox.

The Corporation do not bind themselves to accept the lowest or any offer.

J. D. MARWICK,
Town Clerk.

City Chambers, Glasgow,
June 30, 1900.

THE GASLIGHT AND COKE COMPANY.

TENDERS FOR COKE.

THE Directors of this Company are pre-pared to receive TENDERS for the purchase of COKE, to be supplied into Barges or Railway Trucks, at their Beckton and Nine Elms Stations, within the Twelve Months commencing on the 1st of October next.

Particulars and Forms of Tenders can be obtained upon application at this Office.

Tenders to be sent in so as to be received here not later than Twelve o'clock (noon) on Wednesday, the 25th inst., addressed to me, and endorsed "Tender for Coke."

The Directors do not bind themselves to accept the highest or any Tender.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., July 6, 1900.

CROWBOROUGH DISTRICT WATER COMPANY.

SALE BY TENDER OF 500 NEW ORDINARY SHARES OF £10 EACH.

MINIMUM PRICE £10 PER SHARE—PAR.

NOTICE is Hereby Given, that it is the intention of the Directors of the Crowborough District Water Company to SELL BY TENDER FIVE HUNDRED NEW ORDINARY SHARES of £10 each in accordance with the provisions of the Crowborough District Water Act, 1899. These Shares may rank for Dividend up to 7 per cent. per annum.

Particulars, with Conditions and Form of Tender, may be obtained on application to the undersigned; or to Messrs. Verrall and Borlase, Solicitors, 4 and 5, New Road, Brighton; or to the Company's Bankers, Messrs. Barclay and Company, Limited, Union Bank, Brighton, or at their Head Office, 54, Lombard Street, E.C.

Tenders must be received not later than Twelve o'clock noon, on Friday, the 27th of July, 1900.

The Shares will be allotted to the highest bidders at or above the minimum price.

By order,
HERBERT SPROTT,
Secretary.

Offices: Crowborough, Sussex,
June 26, 1900.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

MAIDSTONE GAS COMPANY.

£5000 THREE PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Wednesday, the 25th of July, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTHEND GAS COMPANY.

ISSUE OF £4500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK, AND £500 NEW ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Wednesday, the 25th of July, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

CROMER GAS COMPANY.

NEW ISSUE OF £1250 FOUR PER CENT. PERPETUAL DEBENTURE STOCK, AND £2750 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Wednesday, July 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

ILFORD GAS COMPANY.

£4000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Wednesday, the 25th of July, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY.

200 £10 SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Wednesday, July 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

BY EDWIN FOX AND BOUSFIELD.

AT THE AUCTION MART,

On Wednesday next, July 11, at Two o'clock, in Lots of Ten Shares each.

By order of the Directors.

TENDRING HUNDRED Water-Works Company. Issue of 554 £10 CLASS "A" PREFERENCE SHARES, fully paid, ranking for a Maximum Dividend of 8 per cent.; the last Dividend on similar Shares being at the rate of 4½ per cent. per annum. The Company was established in 1884, the total Authorized Capital is £70,000 (this issue being the remaining portion of the "A" Shares), supplies water to Harwich, Walton-on-the-Naze, Parkeston, and fifteen other parishes, the whole with a population of nearly 50,000 people, and the above offers a thoroughly safe and improving Investment.

Particulars at Messrs. EDWIN FOX and BOUSFIELD'S OFFICE, 99, Gresham Street, BANK, E.C.; at the COMPANY'S OFFICES, Manningtree, ESSEX, and 3, BLOOMSBURY STREET, W.C.; and of the Solicitors to the Company, Messrs. JONES and GARRARD, Manningtree, ESSEX.

BY EDWIN FOX AND BOUSFIELD.

AT THE AUCTION MART,

On Wednesday next, July 11, at Two o'clock, in Lots.

STOCKS and SHARES in established Undertakings:—

SANDOWN PARK (Racecourse), Limited—100 £10 Shares, Dividend 7 per cent., and Bonus 2 per cent. NEW RIVER COMPANY—£1000 Three per Cent. Debenture Stock, and 10 £100 New Shares (fully paid), Dividend 13¾ per cent. HAMPSTEAD AQUEDUCTS (New River)—5 Shares yielding £5 10s. per annum each, payable for ever. TENDRING HUNDRED WATER-WORKS COMPANY—554 £10 "A" Shares, ranking for Maximum Dividend of 8 per cent., Dividend paid 4½ per cent. BRIGHTON and HOVE GENERAL GAS COMPANY—£600 Original Ordinary Consolidated Stock, Dividend 11½ per cent. DOOM DOOMA TEA COMPANY, Limited—100 £10 Shares, Dividend 13 per cent. SEAGER, EVANS, and COMPANY, Limited—240 £5 Five-and-a-half per Cent. Cumulative Preference Shares. NEW EXPLOSIVES COMPANY, Limited—100 £10 Five-and-a-half per Cent. Debenture Bonds. BALLARD and COMPANY, Limited—£1000 Four per Cent. First Mortgage Debenture Stock. SOUTHGATE ENGINEERING COMPANY, Limited—500 £5 Shares, Dividend 8 per cent.; and in other Companies.

Particulars at Messrs EDWIN FOX and BOUSFIELD'S OFFICE, 99, Gresham Street, BANK, E.C.

NEW RIVER COMPANY.

ISSUE OF

£200,000 THREE PER CENT. DEBENTURE STOCK "D."

NOTICE is Hereby Given, that the Directors are prepared to receive

TENDERS

FOR THE

ABOVE ISSUE

(Being the first portion of the £1,000,000 Debenture Stock "D" authorized by the New River Company's Act, 1897),

bearing Interest at Three per Cent. per Annum, and redeemable at any time after the Expiration of 25 years from the date of issue, upon Six Months' Notice being given by the Company.

The Stock will be issued subject to a Reserved Price.

Tenders must be delivered at the Company's Office, Rosebery Avenue, Clerkenwell, E.C., not later than Eleven a.m., on Thursday, the 19th of July, 1900.

Particulars and Conditions, together with Forms of Tender and the Sections of the Act of 1897, authorizing the Debenture Stock, may be obtained at the said Office, or will be forwarded on application.

This Stock is a lawful Investment for Trustees.

By order of the New River Company,

JAMES SEARLE,
Clerk.

New River Office, Rosebery Avenue,
Clerkenwell, E.C., June, 1900.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS.

By N. H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S.

LONDON:

WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

Now Ready. Price 6s.

LAW OF LONDON GAS COMPANIES

A SYNOPSIS of Public Acts affecting Gas Companies and of the Special Acts of the Metropolitan Companies, with Comments and a Short History: Including a Statement of the effects of the Conversion Acts of the GASLIGHT AND COKE COMPANY, and of the SOUTH METROPOLITAN COMPANY, and an Examination of the Capital and Loan Accounts to date of the three London Companies and of the Bills now before Parliament.

BY

T. J. BARNES,

OF THE MIDDLE TEMPLE *Barrister-at-Law.*

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WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

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of the

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A HISTORY OF THE QUESTION OF PRICE IN LONDON

FROM THE INTRODUCTION OF GAS LIGHTING TO THE PRESENT TIME.

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With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & CO.,

165, QUEEN VICTORIA STREET, E.C.;

And at STROUD, GLOUCESTERSHIRE.

BOLDON GAS COALS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

As per Analysis by

Mr. JOHN PATTINSON, F.I.C., F.C.S.

For Prices, &c., apply to

W. H. PARKINSON,

THE HARTON COAL CO., LTD.,

NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON, NEWCASTLE."

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500	Cub. Ft.
Illuminating Power . . .	16·9	Candles.
Coke (of good quality) . .	67·5	per Cent.
Sulphur	0·58	,,
Ash	2·73	,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

HOLMSIDE GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES

NEWCASTLE-UPON-TYNE.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,

CHESTERFIELD.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

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NEWBATTLE COLLIERIES,

DALKEITH, N.B.

LONDONDERRY GAS COALS

FROM THE

LONDONDERRY COLLIERIES,

COUNTY OF DURHAM.

Available Output up to 5000 Tons per day. Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by

Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR,

COUNTY OF DURHAM.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

HARDMAN & HOLDEN, LD.

ESTABLISHED 1820.

SULPHURIC ACID.

GUARANTEED absolutely free from Arsenic and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.

Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.

Head Office: Miles Platting, MANCHESTER.

Inquiries Solicited.

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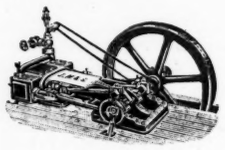
GAS ENGINEERS

MILTON HOUSE WORKS EDINBURGH.

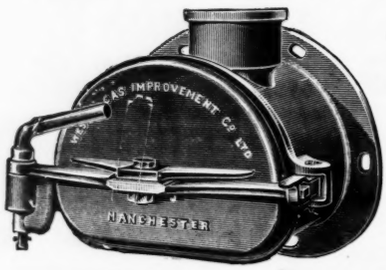
LONDON. —— LEEDS. —— GLASGOW.



WEST'S GAS IMPROVEMENT COMPANY, LTD.

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER;

AND 104, QUEEN VICTORIA STREET, LONDON, E.C.



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GRAHAM, MORTON, & CO.

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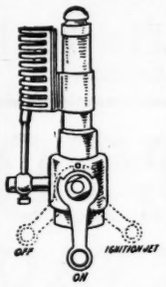
INCLINED RETORT SYSTEM.

GROUP XIV. — CLASS 87. — INDUSTRIE CHIMIQUE.

For Ordinary Burner.



Price 2s. 6d. complete.

THE MACHEBACH GAS-LIGHTERS.

ECONOMY, SAFETY, SIMPLICITY.

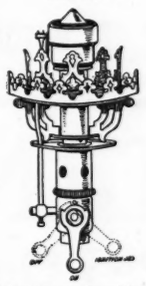
NO MATCHES, TAPERS, ETC., REQUIRED.

SAVES GAS.

Full Particulars of Prices and other Forms of Self-Lighters on application to the

MATCHLESS GAS LIGHTING SYNDICATE, LTD.,
130, Queen Victoria Street, LONDON, E.C.

For Incandescent Burner.



Price 3s. each, without Burner or Mantle.

THE DELLWIK-FLEISCHER WATER-GAS PROCESS

For Increasing the Capacity of Coal-Gas Works, also for Incandescent Lighting, Driving of Gas-Engines, and Manufacturing Purposes.

(PATENTS IN ALL COUNTRIES)

Plants contracted for within the last Eighteen Months for the following Gas-Works: KÖNIGSBERG, ISERLOHN, LYONS, ERFURT, REMSCHEID, PFORTSHEIM, PLAUEN, BARMEN-RITTERSHAUSEN, NUREMBERG BRUMMEN,* OSTERFELD,* WARSTEIN,* WIBORG.*

[* Blue Water Gas with Incandescent Burners.]

ALSO TWENTY-SEVEN INSTALLATIONS FOR MANUFACTURING PURPOSES.

THE DELLWIK-FLEISCHER WATER-GAS SYNDICATE,
25, VICTORIA STREET, WESTMINSTER, LONDON, S.W.

THE "DE BROUWER" PATENT COKE-CONVEYOR

FOR ELEVATING AND CONVEYING.

SUPERSEDES ALL OTHERS FOR DEALING AUTOMATICALLY WITH

— HOT COKE. —

DOES NOT BREAK THE COKE. SIMPLE AND EFFECTIVE.

25 INSTALLATIONS now at Work.

SUITABLE FOR SMALL AS WELL AS LARGE RETORT-HOUSES.

GUARANTEED BY SOLE MAKERS:

W. J. JENKINS & CO., Ltd., RETFORD.

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MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

INCLINED RETORTS

UP-TO-DATE FURNACES AND SETTINGS.

J. & H. ROBUS, 20, Bucklersbury, London, E.C.

BARRY, HENRY, & CO.,

— LIMITED. —

Specialities:

TRANSMISSION OF POWER.

Rope and Belt Pulleys,
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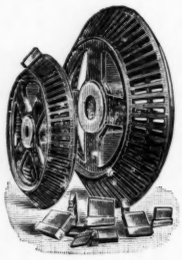

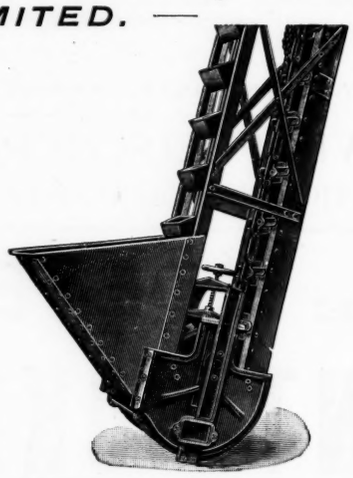

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Conveyors
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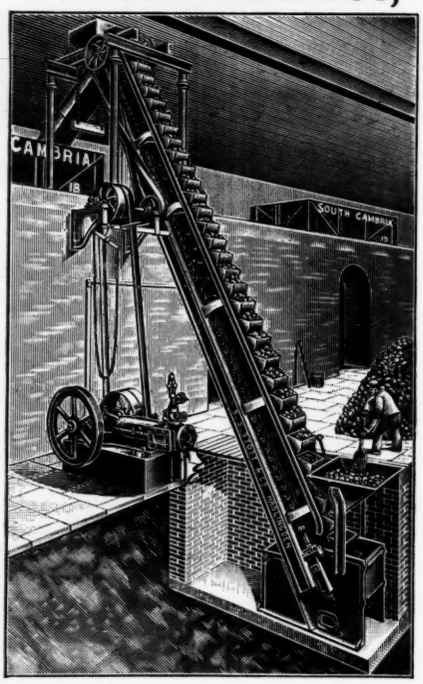

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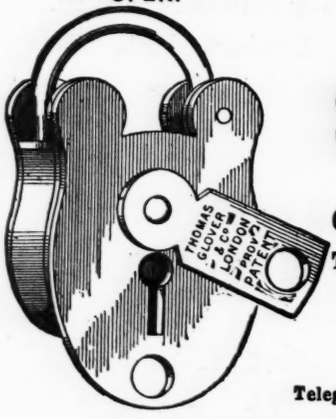

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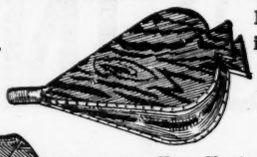

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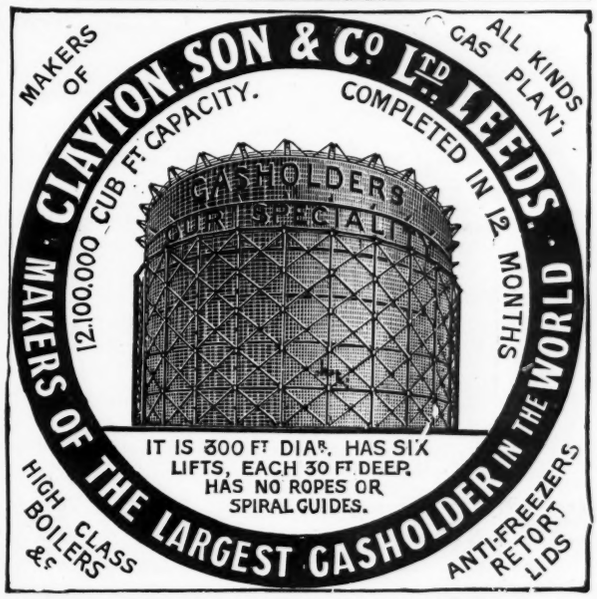
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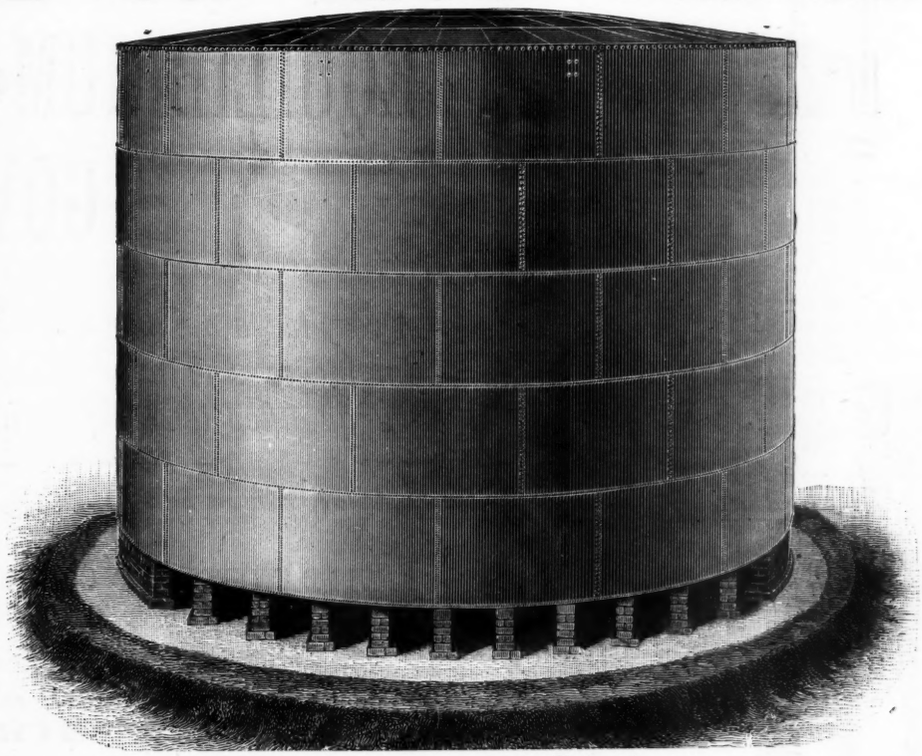

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[See also Advt. p. 74.

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